1997 ENGINE PERFORMANCE

Self-Diagnostics - 4.3L S/T Series

INTRODUCTION

Most engine control problems are the result of mechanical breakdowns, poor electrical connections or damaged vacuum hoses. Before considering the computer system as a possible cause of problems, perform checks and inspections covered in the **BASIC TESTING - 4.3L** article. Failure to do so may result in lost diagnostic time.

If no faults found performing procedures in the BASIC TESTING - 4.3L article, proceed with **DIAGNOSTIC PROCEDURE** under SELF-DIAGNOSTIC SYSTEM. If no fault codes are present and driveability problems exist, proceed to the TESTS W/O CODES article for diagnosis by symptom (i.e., ROUGH IDLE, NO START, etc.). If only intermittent codes are present, see INTERMITTENTS in the TESTS W/O CODES article.

SELF-DIAGNOSTIC SYSTEM

NOTE: For On-Board Diagnostic System Check see the BASIC TESTING - 4.3L article.

NOTE: Powertrain Control Module (PCM) may also be referred to as Vehicle Control Module (VCM) in some diagnostic text and illustrations. Terms may be used interchangeably.

PCM/VCM is equipped with a self-diagnostic system, which detects system failures or abnormalities. When a malfunction occurs, PCM/VCM will store a Diagnostic Trouble Code (DTC) and, in most cases, illuminate the Malfunction Indicator Light (MIL) located on instrument cluster. Malfunctions are recorded as hard failures or as intermittent failures.

There are 4 types of DTC category:

- Type "A" - Emissions related, turns on MIL the first time DTC sets.
- Type "B" - Emissions related, turns on MIL if fault is active for 2 consecutive driving cycles.
- Type "C" - Non-emissions related, does not turn on MIL, but will turn on SERVICE light.
- Type "D" - Non-emissions related, does not turn on MIL or SERVICE light.

HARD FAILURES

Most hard failures cause MIL to illuminate and remain on until malfunction is repaired. If MIL comes on and remains on (light may flash) during vehicle operation, cause of malfunction must be determined. See **DIAGNOSTIC PROCEDURE** .

If a sensor fails, PCM/VCM will use a substitute value in its calculations to continue engine operation. In this condition, vehicle is functional, but it will most likely display degraded driveability.

INTERMITTENT FAILURES

Intermittent failures cause MIL to flicker or glow and go out about 10 seconds after intermittent fault goes away. Corresponding DTC, however, will be retained in PCM/VCM memory. If related fault does not reoccur within 50 engine starts, trouble code will be erased from control module memory. Intermittent failures may be caused by sensor, connector or wiring related problems. See INTERMITTENTS in the TESTS W/O CODES article.

NOTE: OBD II vehicles have options available in the scan tool DTC mode to display enhanced information available. However, to fully utilize information and procedures requires the use of a Tech 1 or 2 scan tool. See scan tool operator's manual for additional information.

The following are Tech 1 or 2 scan tool sub-menus in the DTC INFO and SPECIFIC DTC modes:

DTC INFO MODE

Used to search for a specific type of stored DTC information. There are 7 choices in this mode. Technician may be instructed to test DTC(s) in a certain manner. Follow the affected DTC test procedures. To get complete description of any status, hit ENTER key before pressing the desired F-key.

DTC STATUS

This selection will display any DTC(s) that have not run during the current ignition cycle or have reported a test failure during this ignition up to a maximum of 33 DTCs. DTC test which run and passed will cause that affected DTC to be removed from scan tool screen.

FAIL THIS IGN.

This selection will display all DTCs that have failed during the present ignition cycle.

HISTORY

This selection will display only DTC(s) that are stored in the control module's history memory. It will not type "B" DTCs. It will display all type "A" and type "B" DTCs that have the MIL illuminated and have failed within the last 40 warm-up cycles. It will also display type "C" DTCs that have failed within the 40 warm-up cycles.

LAST TEST FAIL

This selection will display only DTCs that have failed the last time the test ran. The last test may have ran during the previous ignition cycle, if a type "A" or "B" DTC is displayed. For type "C" DTCs, the last failure must have occurred during the current ignition cycle to be displayed as LAST TEST FAIL.

MIL REQUEST

This selection will display only DTCs that are requesting the MIL. Type "C" DTCs cannot be displayed using this option. This selection will report type "B" DTCs only after the MIL has been requested.

NOT RUN SCC

Not Run Since Code Clear option will display up to 33 DTCs that have not run since DTCs were last cleared. Since any displayed DTCs have not run, their condition (passing or failing) is unknown.

TEST FAIL SCC

Test Fail Since Code Clear selection will display all active and history DTCs that have reported a test failure since the last time DTCs were cleared. DTCs that last failed over 40 warm-up cycles before this option is selected will not be displayed.

FAILED SINCE CLEAR

This message indicates the DTC has failed at least once within the last 40 warm-up cycles since the last time DTCs were cleared.

NOT RUN SINCE CL.

Not Run Since Cleared message indicates that the selected diagnostic test has not run since the last time DTCs were cleared. Therefore, the diagnostic test status (passed or failed) is unknown. After DTCs are cleared, this message will continue to be displayed until the diagnostic test runs.

NOT RUN THIS IGN.

Not Run This Ignition message indicates the selected diagnostic test has not run this ignition cycle.

TEST RAN AND PASSED

This message indicates the selected diagnostic test has:

- Passed the last test.
- Ran and passed during this ignition cycle.
- Ran and passed since DTCs were last cleared.
- Test has not failed since DTCs were last cleared.

If this message is displayed, repair is done. If FAILED THIS IGN. message is displayed, repair is incomplete and further diagnosis is required.

DIAGNOSTIC PROCEDURE

Diagnosis of computerized engine control system should be performed in following order:

1. Ensure all engine systems not related to computer system are operating properly. DO NOT proceed with testing unless all other problems have been repaired. ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK must be performed before using specific DTC testing procedure. See the **BASIC TESTING - 4.3L** article.
2. If DTC(s) were displayed, determine whether codes are hard or intermittent trouble codes. Hard codes will cause MIL to illuminate continuously while engine is running. See **HARD OR INTERMITTENT**

TROUBLE CODE DETERMINATION . For diagnosing hard codes, proceed to appropriate DTC test. For diagnosing intermittent codes, proceed to INTERMITTENTS in the TESTS W/O CODES article.

3. If no DTCs are present and a driveability problem exists, refer to SYMPTOMS in the TESTS W/O CODES article. Doing so will help identify proper system or component to check in the SYSTEM/COMPONENT TESTS article.
4. After necessary repairs are made, clear DTCs, verify vehicle will enter "closed loop" operation and ensure DTC does not reset.

READING TROUBLE CODES

NOTE: Use of Tech 1 or 2 scan tool is required to retrieve DTCs. Refer to user reference manuals supplied with scan tool.

HARD OR INTERMITTENT TROUBLE CODE DETERMINATION

During any diagnostic procedure, determine if DTC(s) are hard failure codes or intermittent failure codes. Diagnostic procedures will not always help analyze intermittent codes. To determine hard codes and intermittent codes:

1. Enter diagnostic mode. Read and record all stored DTCs. Exit diagnostic mode, and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES (DTC)** .
2. Apply parking brake, and place transmission in Neutral or Park. Block drive wheels, and start engine. MIL should go out. Operate warm engine at specified RPM for 2 minutes and note MIL.
3. If MIL illuminates, enter diagnostic mode. Read and record DTCs. This will reveal hard failure codes. Oxygen sensor related codes may require a road test to reset hard failure after DTCs were cleared.
4. If MIL does not illuminate, all stored DTCs were intermittent failures, except as noted above.

NOTE: DTCs will be recorded at various operating times. Some codes require operation of that sensor or switch for 5 seconds; others require operation for 5 minutes or longer at normal operating temperature, vehicle speed and load. Therefore, some DTCs may not set in a service bay operational mode and may require road testing vehicle in order to duplicate conditions under which code will set.

CLEARING DIAGNOSTIC TROUBLE CODES (DTC)

To clear DTCs from memory, either to determine if malfunction will occur again or after making necessary repairs, disconnect power supply to ECM/PCM/VCM for at least 30 seconds or clear codes using a scan tool.

ECM/PCM/VCM LOCATION

On most models, ECM/PCM/VCM is located behind right or left side of dash, behind right or left kick panel, or on left or right side of engine compartment. For more precise location, see COMPONENT LOCATIONS in the SYSTEM/COMPONENT TESTS article.

DIAGNOSTIC MATERIALS

Diagnostic Aids

Diagnostic aids are additional tips used to help diagnose trouble codes when inspected circuit is okay. Diagnostic aids may help lead to a definitive solution to trouble code problem.

SPECIAL TOOLS (DIAGNOSTIC)

NOTE: A scan tool plugged into DLC is used to read DTCs and check voltages in system on serial data line. A scan tool is REQUIRED to retrieve vehicle information.

Computerized engine control system is most easily diagnosed using scan tool; however, other tools may aid in diagnosing problems. These tools are a tachometer, test light, ohmmeter, digital voltmeter with a 10-megohm input impedance (minimum), vacuum pump, vacuum gauge, fuel injector test lights and 6 jumper wires 6" long (one wire with female connectors at both ends, one wire with male connectors at both ends and 4 wires with male and female connectors at opposite ends). A test light, rather than a voltmeter, must be used when indicated by a diagnostic test. In addition, special jumper harnesses or testers may be required by manufacturer to facilitate diagnosis.

SCAN TOOL USAGE

NOTE: Before connecting scan tool to vehicle, diagnostic system should be checked to determine if system is operating properly and if information received will be accurate. This is done by performing ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK located in the BASIC TESTING - 4.3L article. If vehicle does not pass OBD system check, information received may be invalid.

Scan tool is a specialized tester which, when plugged into DLC, can be used to diagnose on-board computer control systems by providing instant access to circuit voltage information without need to crawl under dash or hood to backprobe sensors and connectors.

Scan tool cuts down diagnostic time dramatically by furnishing input data (voltage signals) which can be compared to specification parameters. See **SCAN DATA** . They may also furnish information on output device (solenoids and motors) status. However, status parameters only indicate output signals have been sent to devices by PCM/VCM; they do not indicate whether devices have responded properly to signal. Verify proper response at output device using a voltmeter or test light.

A problem may exist even if DTCs are not present. About 80 percent of driveability problems occur without DTCs. Sensors that are out of calibration will not set a DTC but will cause driveability problems.

Using a scan tool is the easiest method of checking sensor specifications and other data parameters. Scan tool is also useful in finding intermittent wiring problems by wiggling wiring harnesses and connections (key on, engine off) while observing data parameters. See SCAN DATA.

NOTE: **If erroneous voltage signals are suspected, verify tester information using a digital voltmeter and wiring schematic. If non-existent codes are displayed, DO NOT use scan tool for diagnosis. Contact tester manufacturer for additional information.**

SCAN DATA

NOTE: **For scan data values, refer to scan tool manufacturer owner's manual or compare values with a known good component or vehicle.**

DTC DEFINITIONS

TROUBLE CODE DEFINITIONS

TROUBLE CODE DEFINITIONS

Code No.	Circuit Affected
P0101	MAF System Performance
P0102	MAF Sensor Circuit Low Frequency
P0103	MAF Sensor Circuit High Frequency
P0106	MAP Sensor System Performance
P0107	MAP Sesnor Circuit Low Voltage
P0108	MAP Sensor Circuit High Voltage
P0112	IAT Sensor Circuit Low Voltage
P0113	IAT Sensor Circuit High Voltage
P0117	ECT Sensor Circuit Low Voltage
P0118	ECT Sensor Circuit High Voltage
P0121	TP Sensor System Performance
P0122	TP Sensor Circuit Low Voltage
P0123	TP Sensor Circuit High Voltage
P0125	ECT Excessive Time To Reach Closed Loop
P0131	HO2S Circuit Low Voltage-Bank 1, Sensor 1
P0132	HO2S Circuit High Voltage-Bank 1, Sensor 1
P0133	HO2S Slow Response-Bank 1, Sensor 1
P0134	HO2S Insufficient Activity-Bank 1, Sensor 1
P0135	HO2S Heater Circuit-Bank 1, Sensor 1
P0137	HO2S Circuit Low Voltage-Bank 1, Sensor 2
P0138	HO2S Circuit High Voltage Bank 1, Sensor 2
P0140	HO2S Insufficient Activity-Bank 1, Sensor 2
P0141	HO2S Heater Circuit-Bank 1, Sensor 2
P0143	HO2S Circuit Low Voltage-Bank 1, Sensor 3
P0144	HO2S Circuit High Voltage-Bank 1, Sensor 3
P0146	HO2S Insufficient Activity-Bank 1, Sensor 3

P0147	HO2S Heater Circuit-Bank 1, Sensor 3
P0151	HO2S Circuit Low Voltage-Bank 2, Sensor 1
P0152	HO2S Circuit High Voltage-Bank 2, Sensor 1
P0153	HO2S Slow Response-Bank 2, Sensor 1
P0154	HO2S Insufficient Activity-Bank 2, Sensor 1
P0155	HO2S Heater Circuit-Bank 2, Sensor 1
P0171	Fuel Trim System Lean-Bank 1
P0172	Fuel Trim System Rich-Bank 1
P0174	Fuel Trim System Lean-Bank 2
P0175	Fuel Trim System Rich-Bank 2
P0300	Engine Misfire Detected
P0301	Cyl. No. 1 Misfire Detected
P0302	Cyl. No. 2 Misfire Detected
P0303	Cyl. No. 3 Misfire Detected
P0304	Cyl. No. 4 Misfire Detected
P0305	Cyl. No. 5 Misfire Detected
P0306	Cyl. No. 6 Misfire Detected
P0327	Knock Sensor Low Voltage
P0336	CKP Sensor Circuit Performance
P0337	CKP Sensor Circuit Low Frequency
P0338	CKP Sensor Circuit High Frequency
P0339	CKP Sensor Circuit Intermittent
P0340	CKP Sensor Circuit
P0341	CMP Sensor Circuit Performance
P0401	EGR System Performance
P0420	TWC System Low Efficiency-Bank 1
P0461	Fuel Level Sensor Circuit Malfunction
P0462	Fuel Level Sensor Circuit Low Voltage
P0463	Fuel Level Sensor Circuit High Voltage
P0500	Vehicle Speed Sensor Circuit
P0506	Idle RPM Low (IAC Responding)
P0507	Idle RPM High (IAC Responding)
P0704	Clutch Switch Circuit
P1106	MAP Sensor Circuit Intermittentl High Voltage
P1107	MAP Sensor Circuit Intermittentl Low Voltage
P1111	IAT Sensor Circuit Intermittent High Voltage
P1112	IAT Sensor Circuit Intermittent Low Voltage
P1114	ECT Sensor Circuit Intermittent Low Voltage
P1115	ECT Sensor Circuit Intermittent High Voltage
P1121	TP Sensor Voltage Intermittentl High
P1122	TP Sensor Voltage Intermittentl Low

	HO2S Insufficient Switching-Bank 1, Sensor 1
P1134	HO2S Transition Time Ratio-Bank 1, Sensor 1
P1153	HO2S Insufficient Switching-Bank 2, Sensor 1
P1154	HO2S Transition Time Ratio-Bank 2, Sensor 1
P1345	CKP/CMP Sesnor Correlation
P1351	IC Circuit High Voltage
P1361	IC Circuit Low Voltage
P1380	EBCM DTC Detected Rough Road Data Unusable
P1381	Misfire Detected-No EBCM/PCM/VCM Serial Data
P1441	EVAP System Flow During Non-Purge
P1508	IAC System-Low RPM
P1509	IAC System-High RPM

SUMMARY

If no hard fault codes are present, driveability symptoms exist or intermittent DTC(s) exist, proceed to the TESTS W/O CODES article for diagnosis by symptom (i.e., ROUGH IDLE, NO START, etc.) or intermittent diagnostic procedures.

CONNECTOR IDENTIFICATION

NOTE: For additional connector and terminal identification, see CONNECTOR IDENTIFICATION - S/T SERIES article.

VCM CONNECTORS

C1

Vehicle Control Module Connector C1 (W/ M/T)

Connector Part Information	• 12129025 • 32 - Way F Micro-Pack 100 W Series (Natural) W/ Blue Color Sleeve		
Pin	**Wire Color**	**Circuit No.**	**Function**
1	—	—	Not used
2	—	—	Not used
3	BRN/WHT	633	Camshaft Position Sensor signal
4	PNK	539	Ignition Feed - Fused
5	YEL/BLK	846	Fuel Injector #6 driver
6	—	—	Not used
7	TAN	1667	Right Front Heated Oxygen Sensor low
8	PNK/BLK	632	Camshaft Position Sensor ground
9	—	—	Not used
10	—	—	Not used
11	—	—	Not used
12	DK GRN/WHT	428	EVAP Canister Purge Solenoid Valve driver
13	—	—	Not used
14	—	—	Not used
15	YEL/BLK	1827	Vehicle Speed Signal To Electronic Brake Control Module
16	—	—	Not used
17	—	—	Not used
18	GRY	435	Exhaust Gas Recirculation Valve control

Connector Part Information	• 12129025 • 32 - Way F Micro-Pack 100 W Series (Natural) W/ Blue Color Sleeve		
Pin	**Wire Color**	**Circuit No.**	**Function**
19	PPL/WHT	1665	LH Front Heated Oxygen Sensor signal
20	PPL	1670	Pre-Converter Heated Oxygen Sensor signal
21	PPL	1666	RH Front Heated Oxygen Sensor signal
22	PPL/WHT	1668	Post-Converter Heated Oxygen Sensor signal
23	BLK/WHT	451	Ground
24	TAN	1671	Pre-Converter Heated Oxygen Sensor low
25	TAN/WHT	1653	LH Front Heated Oxygen Sensor low
26	TAN/WHT	1669	Post-Converter Heated Oxygen Sensor low
27	—	—	Not used
28	PPL	574	Crankshaft Position Sensor signal
29	LT GRN/BLK	822	Vehicle Speed Sensor low
30	PPL/WHT	821	Vehicle Speed Sensor high
31	YEL	573	Crankshaft Position Sensor ground
32	—	—	Not used

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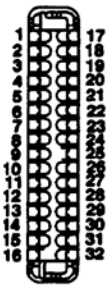
Fig. 1: VCM 32-Pin Connector C1 (Blue) - With M/T
Courtesy of GENERAL MOTORS CORP.

Vehicle Control Module Connector C1 (W/ A/T)



Connector Part Information		• 12129025 • 32 - Way F Micro-Pack 100 W Series (Natural) W/ Blue Color Sleeve	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	—	—	Not used
2	—	—	Not used
3	BRN/WHT	633	Camshaft Position Sensor signal
4	PNK	539	Ignition Feed - Fused
5	YEL/BLK	846	Fuel Injector #6 driver
6	—	—	Not used
7	TAN	1667	Right Front Heated Oxygen Sensor low
8	PNK/BLK	632	Camshaft Position Sensor ground
9	—	—	Not used
10	TAN/BLK	422	Torque Converter Clutch Solenoid Valve control
11	—	—	Not used
12	DK GRN/WHT	428	Canister Purge Solenoid Output
13	WHT	687	3-2 Shift Solenoid Valve Assembly control
14	—	—	Not used
15	YEL/BLK	1827	Vehicle Speed Signal To Electronic Brake Control Module
16	—	—	Not used
17	—	—	Not used

Connector Part Information		• 12129025 • 32 - Way F Micro-Pack 100 W Series (Natural) W/ Blue Color Sleeve	
Pin	**Wire Color**	**Circuit No.**	**Function**
18	GRY	435	Exhaust Gas Recirculation Valve control
19	PPL/WHT	1665	LH Front Heated Oxygen Sensor signal
20	PPL	1670	Pre-Converter Heated Oxygen Sensor signal
21	PPL	1666	RH Front Heated Oxygen Sensor signal
22	PPL/WHT	1668	Post-Converter Heated Oxygen Sensor signal
23	BLK/WHT	451	Ground
24	TAN	1671	Pre-Converter Heated Oxygen Sensor low
25	TAN/WHT	1653	LH Front Heated Oxygen Sensor low
26	TAN/WHT	1669	Post-Converter Heated Oxygen Sensor low
27	—	—	Not used
28	PPL	574	Crankshaft Position Sensor signal
29	LT GRN/BLK	822	Vehicle Speed Sensor low
30	PPL/WHT	821	Vehicle Speed Sensor high
31	YEL	573	Crankshaft Position Sensor ground
32	—	—	Not used

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Fig. 2: VCM 32-Pin Connector C1 (Blue) - With A/T
Courtesy of GENERAL MOTORS CORP.

C2

Vehicle Control Module Connector C2 (Red) (W/ M/T, W/O A/C)

Connector Part Information		• 12129025 • 32 - Way F Micro-Pack 100 W Series (Natural) W/ Red Color Sleeve	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	—	—	Not used
2	WHT	1310	EVAP Canister Vent Valve Solenoid driver
3	BLK	1744	Fuel Injector #1 driver
4	—	—	Not used
5	—	—	Not used
6	—	—	Not used
7	—	—	Not used
8	—	—	Not used
9	—	—	Not used
10	BRN	1456	EGR Valve Pintle Position signal
11	—	—	Not used
12	—	—	Not used
13	LT GRN/WHT	1749	Idle Air Control Valve - Coil B High
14	LT BLU/WHT	1747	Idle Air Control Valve - Coil A High
15	LT GRN/BLK	1745	Fuel Injector #2 driver
16	PNK/BLK	1746	Fuel Injector #3 driver
17	—	—	Not used
18	—	—	Not used
19	DK BLU	496	Knock Sensor signal

Connector Part Information		• 12129025 • 32 - Way F Micro-Pack 100 W Series (Natural) W/ Red Color Sleeve	
Pin	**Wire Color**	**Circuit No.**	**Function**
20	—	—	Not used
21	LT GRN	432	Manifold Absolute Pressure Sensor signal
22	TAN	472	Intake Air Temperature Sensor signal
23	YEL	410	Engine Coolant Temperature Sensor signal
24	DK BLU	417	Throttle Position Sensor signal
25	DK GRN	890	Fuel Tank Vapor Pressure Sensor signal
26	BLK	950	PC Board grounding strap
27	—	—	Not used
28	YEL	492	Mass Air Flow Sensor signal
29	LT GRN/BLK	444	Idle Air Control Valve - Coil B Low
30	LT BLU/BLK	1748	Idle Air Control Valve - Coil A Low
31	BLK/WHT	845	Fuel Injector #5 driver
32	LT BLU/BLK	844	Fuel Injector #4 driver

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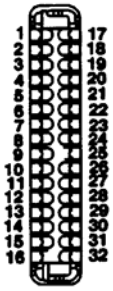
Fig. 3: VCM 32-Pin Connector C2 (Red) - With M/T, Without A/C
Courtesy of GENERAL MOTORS CORP.

Vehicle Control Module Connector C2 (Red) (W/ M/T, W/ A/C)



Connector Part Information		• 12129025 • 32 - Way F Micro-Pack 100 W Series (Natural) W/ Red Color Sleeve	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	—	—	Not used
2	WHT	1310	EVAP Canister Vent Valve Solenoid driver
3	BLK	1744	Fuel Injector #1 driver
4	—	—	Not used
5	—	—	Not used
6	—	—	Not used
7	—	—	Not used
8	—	—	Not used
9	DK GRN/WHT	459	A/C Compressor Relay control
10	BRN	1456	EGR Valve Pintle Position signal
11	—	—	Not used
12	—	—	Not used
13	LT GRN/WHT	1749	Idle Air Control Valve - Coil B High
14	LT BLU/WHT	1747	Idle Air Control Valve - Coil A High
15	LT GRN/BLK	1745	Fuel Injector #2 driver
16	PNK/BLK	1746	Fuel Injector #3 driver
17	—	—	Not used
18	—	—	Not used

Connector Part Information		• 12129025 • 32 - Way F Micro-Pack 100 W Series (Natural) W/ Red Color Sleeve	
Pin	**Wire Color**	**Circuit No.**	**Function**
19	DK BLU	496	Knock Sensor signal
20	—	—	Not used
21	LT GRN	432	Manifold Absolute Pressure Sensor signal
22	TAN	472	Intake Air Temperature Sensor signal
23	YEL	410	Engine Coolant Temperature Sensor signal
24	DK BLU	417	Throttle Position Sensor signal
25	DK GRN	890	Fuel Tank Vapor Pressure Sensor signal
26	BLK	950	PC Board grounding strap
27	—	—	Not used
28	YEL	492	Mass Air Flow Sensor signal
29	LT GRN/BLK	444	Idle Air Control Valve - Coil B Low
30	LT BLU/BLK	1748	Idle Air Control Valve - Coil A Low
31	BLK/WHT	845	Fuel Injector #5 driver
32	LT BLU/BLK	844	Fuel Injector #4 driver

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Fig. 4: VCM 32-Pin Connector C2 (Red) - With M/T, With A/C
Courtesy of GENERAL MOTORS CORP.

Vehicle Control Module Connector C2 (Red) (W/ A/T, W/O A/C)

Connector Part Information		• 12129025 • 32 - Way F Micro-Pack 100 W Series (Natural) W/ Red Color Sleeve	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	—	—	Not used
2	WHT	1310	EVAP Canister Vent Valve Solenoid driver
3	BLK	1744	Fuel Injector #1 driver
4	YEL/BLK	1223	2-3 Shift Solenoid Valve control
5	—	—	Not used
6	LT GRN	1222	1-2 Shift Solenoid Valve control
7	BRN	418	TCC PWM Solenoid Valve control
8	—	—	Not used
9	—	—	Not used
10	BRN	1456	EGR Valve Pintle Position signal
11	—	—	Not used
12	—	—	Not used
13	LT GRN/WHT	1749	Idle Air Control Valve - Coil B High
14	LT BLU/WHT	1747	Idle Air Control Valve - Coil A High
15	LT GRN/BLK	1745	Fuel Injector #2 driver
16	PNK/BLK	1746	Fuel Injector #3 driver
17	—	—	Not used
18	—	—	Not used

Connector Part Information		• 12129025 • 32 - Way F Micro-Pack 100 W Series (Natural) W/ Red Color Sleeve	
Pin	**Wire Color**	**Circuit No.**	**Function**
19	DK BLU	496	Knock Sensor signal
20	—	—	Not used
21	LT GRN	432	Manifold Absolute Pressure Sensor signal
22	TAN	472	Intake Air Temperature Sensor signal
23	YEL	410	Engine Coolant Temperature Sensor signal
24	DK BLU	417	Throttle Position Sensor signal
25	DK GRN	890	Fuel Tank Vapor Pressure Sensor signal
26	BLK	950	PC Board grounding strap
27	YEL/BLK	1227	Transmission Fluid Temperature Sensor signal
28	YEL	492	Mass Air Flow Sensor signal
29	LT GRN/BLK	444	Idle Air Control Valve - Coil B Low
30	LT BLU/BLK	1748	Idle Air Control Valve - Coil A Low
31	BLK/WHT	845	Fuel Injector #5 driver
32	LT BLU/BLK	844	Fuel Injector #4 driver

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Fig. 5: VCM 32-Pin Connector C2 (Red) - With A/T, Without A/C
Courtesy of GENERAL MOTORS CORP.

Vehicle Control Module Connector C2 (Red) (W/ A/T, W/ A/C)

Connector Part Information		• 12129025 • 32 - Way F Micro-Pack 100 W Series (Natural) W/ Red Color Sleeve	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	—	—	Not used
2	WHT	1310	EVAP Canister Vent Valve Solenoid driver
3	BLK	1744	Fuel Injector #1 driver
4	YEL/BLK	1223	2-3 Shift Solenoid Valve control
5	—	—	Not used
6	LT GRN	1222	1-2 Shift Solenoid Valve control
7	BRN	418	TCC PWM Solenoid Valve control
8	—	—	Not used
9	DK GRN/WHT	459	A/C Compressor Relay control
10	BRN	1456	EGR Valve Pintle Position signal
11	—	—	Not used
12	—	—	Not used
13	LT GRN/WHT	1749	Idle Air Control Valve - Coil B High
14	LT BLU/WHT	1747	Idle Air Control Valve - Coil A High
15	LT GRN/BLK	1745	Fuel Injector #2 driver
16	PNK/BLK	1746	Fuel Injector #3 driver
17	—	—	Not used
18	—	—	Not used

Connector Part Information		• 12129025 • 32 - Way F Micro-Pack 100 W Series (Natural) W/ Red Color Sleeve	
Pin	**Wire Color**	**Circuit No.**	**Function**
19	DK BLU	496	Knock Sensor signal
20	—	—	Not used
21	LT GRN	432	Manifold Absolute Pressure Sensor signal
22	TAN	472	Intake Air Temperature Sensor signal
23	YEL	410	Engine Coolant Temperature Sensor signal
24	DK BLU	417	Throttle Position Sensor signal
25	DK GRN	890	Fuel Tank Vapor Pressure Sensor signal
26	BLK	950	PC Board grounding strap
27	YEL/BLK	1227	Transmission Temperature Sensor Signal
28	YEL	492	Mass Air Flow Sensor signal
29	LT GRN/BLK	444	Idle Air Control Valve - Coil B Low
30	LT BLU/BLK	1748	Idle Air Control Valve - Coil A Low
31	BLK/WHT	845	Fuel Injector #5 driver
32	LT BLU/BLK	844	Fuel Injector #4 driver

G00164935

Fig. 6: VCM 32-Pin Connector C2 (Red) - With A/T, With A/C
Courtesy of GENERAL MOTORS CORP.

C3

Vehicle Control Module Connector C3 (Clear) (W/ M/T, W/O A/C)

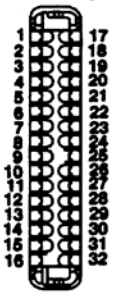
Connector Part Information		• 12129025 • 32 - Way F Micro-Pack 100 W Series (Natural) W/ Clear Color Sleeve	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	—	—	Not used
2	—	—	Not used
3	—	—	Not used
4	BLK	452	ECT and TP Sensors ground
5	—	—	Not used
6	—	—	Not used
7	—	—	Not used
8	—	—	Not used
9	WHT	423	Ignition timing signal output
10	—	—	Not used
11	—	—	Not used
12	GRY	416	5 Volt Reference to Throttle Position Sensor
13	BRN/WHT	379	Input from Clutch Pedal Position And Cruise Control Shutoff Switch
14	—	—	Not used
15	—	—	Not used

Connector Part Information		• 12129025 • 32 - Way F Micro-Pack 100 W Series (Natural) W/ Clear Color Sleeve	
Pin	**Wire Color**	**Circuit No.**	**Function**
16	—	—	Not used
17	TAN/WHT	551	Engine ground
18	BLK	950	PC Board grounding strap
19	BLK	470	Sensor ground
20	—	—	Not used
21	ORN	440	Battery feed - fused
22	—	—	Not used
23	—	—	Not used
24	—	—	Not used
25	—	—	Not used
26	—	—	Not used
27	GRY	474	Sensor 5 Volt reference voltage output
28	—	—	Not used
29	—	—	Not used
30	—	—	Not used
31	—	—	Not used
32	—	—	Not used

G00164936

Fig. 7: VCM 32-Pin Connector C3 (Clear) - With M/T, Without A/C
Courtesy of GENERAL MOTORS CORP.

Vehicle Control Module Connector C3 (Clear) (W/ M/T, W/ A/C)



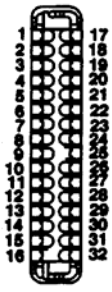
Connector Part Information		• 12129025 • 32 - Way F Micro-Pack 100 W Series (Natural) W/ Clear Color Sleeve	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	—	—	Not used
2	—	—	Not used
3	—	—	Not used
4	BLK	452	ECT and TP Sensors ground
5	—	—	Not used
6	—	—	Not used
7	—	—	Not used
8	—	—	Not used
9	WHT	423	Ignition timing signal output
10	—	—	Not used
11	—	—	Not used
12	GRY	416	5 Volt Reference to Throttle Position Sensor
13	BRN/WHT	379	Input from Clutch Pedal Position And Cruise Control Shutoff Switch
14	—	—	Not used
15	—	—	Not used
16	—	—	Not used
17	TAN/WHT	551	Engine ground

Connector Part Information		• 12129025 • 32 - Way F Micro-Pack 100 W Series (Natural) W/ Clear Color Sleeve	
Pin	**Wire Color**	**Circuit No.**	**Function**
18	BLK	950	PC Board grounding strap
19	BLK	470	Sensor ground
20	—	—	Not used
21	ORN	440	Battery feed - fused
22	—	—	Not used
23	—	—	Not used
24	—	—	Not used
25	DK GRN/WHT	762	A/C Request signal input
26	—	—	Not used
27	GRY	474	Sensor 5 Volt reference voltage output
28	—	—	Not used
29	—	—	Not used
30	DK GRN/WHT	214	A/C Compressor Cycling Switch Signal
31	—	—	Not used
32	—	—	Not used

G00164937

Fig. 8: VCM 32-Pin Connector C3 (Clear) - With M/T, With A/C
Courtesy of GENERAL MOTORS CORP.

Vehicle Control Module Connector C3 (Clear) (W/ A/T, W/O A/C)



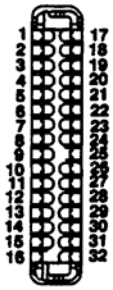
Connector Part Information		• 12129025 • 32 - Way F Micro-Pack 100 W Series (Natural) W/ Clear Color Sleeve	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	—	—	Not used
2	—	—	Not used
3	—	—	Not used
4	BLK	452	ECT and TP Sensors ground
5	—	—	Not used
6	RED/BLK	1228	Pressure Control Solenoid high
7	—	—	Not used
8	—	—	Not used
9	WHT	423	Ignition timing signal output
10	—	—	Not used
11	RED	1226	Transmission Range C input
12	GRY	416	5 Volt Reference to Throttle Position Sensor
13	—	—	Not used
14	—	—	Not used
15	—	—	Not used
16	LT BLU/WHT	1229	Pressure Control Solenoid Valve low

Connector Part Information		• 12129025 • 32 - Way F Micro-Pack 100 W Series (Natural) W/ Clear Color Sleeve	
Pin	**Wire Color**	**Circuit No.**	**Function**
17	TAN/WHT	551	Engine ground
18	BLK	950	PC Board grounding strap
19	BLK	470	Sensor ground
20	—	—	Not used
21	ORN	440	Battery feed - fused
22	DK BLU	1225	Transmission Range B input
23	PNK	1224	Transmission Range A input
24	—	—	Not used
25	—	—	Not used
26	—	—	Not used
27	GRY	474	Sensor 5 Volt reference voltage output
28	—	—	Not used
29	—	—	Not used
30	—	—	Not used
31	—	—	Not used
32	—	—	Not used

G00164938

Fig. 9: VCM 32-Pin Connector C3 (Clear) - With A/T, Without A/C
Courtesy of GENERAL MOTORS CORP.

Vehicle Control Module Connector C3 (Clear) (W/ A/T, W/ A/C)



Connector Part Information		• 12129025 • 32 - Way F Micro-Pack 100 W Series (Natural) W/ Clear Color Sleeve	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	—	—	Not used
2	—	—	Not used
3	—	—	Not used
4	BLK	452	ECT and TP Sensors ground
5	—	—	Not used
6	RED/BLK	1228	Pressure Control Solenoid high
7	—	—	Not used
8	—	—	Not used
9	WHT	423	Ignition timing signal output
10	—	—	Not used
11	DK GRN/WHT	1226	Transmission Range C input
12	GRY	416	5 Volt Reference to Throttle Position Sensor
13	—	—	Not used
14	—	—	Not used
15	—	—	Not used
16	LT BLU/WHT	1229	Pressure Control Solenoid Valve low
17	TAN/WHT	551	Engine ground

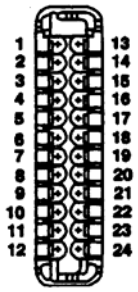
Connector Part Information		• 12129025 • 32 - Way F Micro-Pack 100 W Series (Natural) W/ Clear Color Sleeve	
Pin	**Wire Color**	**Circuit No.**	**Function**
18	BLK	950	PC Board grounding strap
19	BLK	470	Sensor ground
20	—	—	Not used
21	ORN	440	Battery feed - fused
22	DK BLU	1225	Transmission Range B input
23	PNK	1224	Transmission Range A input
24	—	—	Not used
25	DK GRN/WHT	762	A/C Request signal input
26	—	—	Not used
27	GRY	474	Sensor 5 Volt reference voltage output
28	—	—	Not used
29	—	—	Not used
30	DK GRN/WHT	214	A/C Compressor Cycling Switch Signal
31	—	—	Not used
32	—	—	Not used

G00164939

Fig. 10: VCM 32-Pin Connector C3 (Clear) - With A/T, With A/C
Courtesy of GENERAL MOTORS CORP.

C4

Vehicle Control Module Connector C4 (Natural)



Connector Part Information	• 12129225 • 24 - Way F Micro-Pack 100 W Series, Sealed (Natural)		
Pin	**Wire Color**	**Circuit No.**	**Function**
1	DK GRN/WHT	465	Fuel Pump Relay control
2	—	—	Not used
3	DK GRN/WHT	817	Vehicle speed signal to Cruise Control Module
4	DK GRN	389	Vehicle speed signal to Instrument Cluster
5	BRN/WHT	419	Malfunction Indicator Lamp control
6	—	—	Not used
7	—	—	Not used
8	—	—	Not used
9	—	—	Not used
10	PPL	420	Brake switch input from TCC Brake And Cruise Control Release Switch
11	PPL	1807	Serial Data Signal (Class II)
12	BLK/WHT	533	Fuel level return from Fuel Level Buffer Module

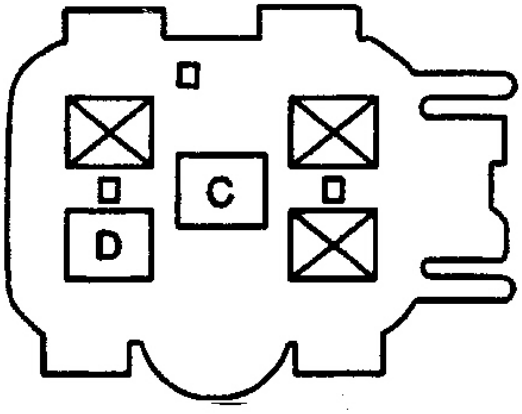
Connector Part Information	• 12129225 • 24 - Way F Micro-Pack 100 W Series, Sealed (Natural)		
Pin	**Wire Color**	**Circuit No.**	**Function**
13	BRN	441	Ignition feed - fused (BRAKE Fuse 12)
14	PPL/WHT	1589	Fuel level input from the Fuel Level Buffer Module
15	TAN/BLK	456	Shift Indicator control to Instrument Cluster
16	—	—	Not used
17	—	—	Not used
18	PNK	439	Ignition feed - fused (ECM IGN Fuse 10)
19	BLK/WHT	1695	Four wheel drive Front Axle Switch input
20	—	—	Not used
21	—	—	Not used
22	—	—	Not used
23	GRY/BLK	1694	Four wheel drive low range selected input
24	LT BLU/BLK	396	Cruise control engaged input from Cruise Control Module

G00164940

Fig. 11: VCM 32-Pin Connector C4 (Natural)
Courtesy of GENERAL MOTORS CORP.

C5

Vehicle Control Module Connector C5



Connector Part Information		• 12176428 • 5 - Way F Metri - Pack 280 Series (Black)	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	—	—	Blocked
B	—	—	Blocked
C	WHT	1510	Antilock Brake System jumper
D	WHT	1510	Antilock Brake System jumper
E	—	—	Blocked

G00164941

Fig. 12: VCM 32-Pin Connector C5 (Black)
Courtesy of GENERAL MOTORS CORP.

DIAGNOSTIC TROUBLE CODES

NOTE: **Before clearing DTCs, perform On-Board Diagnostic (OBD) System Check. See the BASIC TESTING - 4.3L article. Record FREEZE FRAME and FAILURE**

RECORDS for reference during testing. Data will be erased when DTCs are cleared. If PCM/VCM is replaced, NEW PCM/VCM must be programmed using special manufacturer's equipment.

DTC P0101 - MAF SENSOR SYSTEM PERFORMANCE

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Mass Airflow (MAF) sensor measures amount of air entering engine during a given time. VCM uses MAF sensor information for fuel delivery calculations. MAF sensor readings during acceleration are much higher than those during deceleration or idle.

VCM calculates what MAF sensor reading should be received from sensor under certain conditions using engine speed (RPM), throttle position, and altitude parameters. When these test conditions are met, VCM will compare its calculated MAF value to actual value received from sensor.

Conditions required to test for DTC are:

- Vehicle driven at a steady speed.
- No MAP or TP sensor DTCs are set.
- No EVAP system DTCs are set.
- EGR DTC P0401 not set.
- MAF sensor DTC P0102 or P0103 not set.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Turn ignition on, with engine off. Using scan tool, read and record FAIL RECORD data. Operate vehicle within conditions noted in FAIL RECORD data. Using scan tool, read SPECIFIC DTC. If scan tool displays DTC P0101, go to next step. If DTC P0101 is not displayed, see DIAGNOSTIC AIDS.
3. Check for throttle body inlet screen blockage. Check for vacuum leaks at intake manifold, throttle body or EGR valve flange and pipes. Check for crankcase valve faulty, missing or incorrectly installed. Repair faulty conditions as necessary and go to step 17). If no faulty conditions exist, go to next step.
4. Turn ignition on, throttle closed. Using scan tool, read TP ANGLE value. If scan tool displays about zero percent, go to next step. If scan tool does not display zero percent, go to **DTC P0121** .
5. Turn ignition off. Disconnect MAF sensor harness connector. Turn ignition on, engine off. Using a DVOM, check voltage between MAF sensor harness connector signal circuit and chassis ground. If voltage is about 5 volts, go next step. If voltage is not as specified, go to step 7).
6. Connect a test light between MAF sensor harness connector ignition feed and ground circuits. If test light

illuminates, go to step 10). If test light does not illuminate, go to step 9).

7. If voltage is less than 4.5 volts, go to step 11). If voltage is 4.5 volts or greater, go to next step.
8. Turn ignition off. Disconnect VCM connectors. Turn ignition on, engine off. Check voltage between VCM harness connector MAF signal circuit and chassis ground. If voltage reading is about zero volts, go to step 16). If voltage is not as specified, go to step 14),
9. Connect test light between MAF sensor harness connector ignition feed circuit and chassis ground. If test light illuminates, go to step 12). If test light does not illuminate, go to step 13).
10. Check for faulty connection at MAF sensor. Repair connection as necessary and go to step 17). If connection is okay, go to step 15).
11. Check MAF sensor signal circuit between VCM and MAF sensor for open or short to ground. Repair signal circuit as necessary and go to step 17). If signal circuit is okay, go to step 16).
12. Locate and repair open in the MAF sensor ground circuit. After repairs, go to step 17).
13. Locate and repair open MAF sensor ignition feed circuit. After repairs, go to step 17).
14. Locate and repair short to voltage in MAF sensor signal circuit. After repairs, go to step 17).
15. Replace MAF sensor. After replacing sensor, go to step 17).
16. Replace VCM. Program replacement VCM using required equipment. After replacement, go to next step.
17. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0101. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
18. Using scan tool, read and record REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for stuck or faulty Throttle Position (TP) sensor. Using scan tool, read TP ANGLE value with throttle closed. If value is not zero percent, check for and repair the following condition(s):

- Throttle plate sticking or excessive deposits on throttle plate or throttle bore.
- TP sensor signal circuit shorted to voltage.
- Faulty connection or high resistance in TP sensor ground circuit.

If none of the listed conditions exist and TP ANGLE value is not zero percent, replace TP sensor.

Check for faulty connections or damaged harness. Ensure harness is not routed too close to high-voltage wires, such as spark plug cables. If connections and harness appear okay, observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

Check for plugged intake air duct or dirty air filter. A wide-open throttle acceleration from a stop should cause MAF reading on scan tool to increase from about 5-7 grams at idle to about 100 grams or greater at time of 1-2 shift. If not, check for restriction.

Check for a skewed MAP sensor, which can cause Barometric (BARO) pressure reading to be incorrectly calculated. This condition may also cause high Idle Air Control (IAC) counts. If IAC counts are high, replace

MAP sensor.

Check for vacuum leaks at following locations:

- Air inlet duct between MAF sensor and throttle body.
- "O" rings at fuel meter body.
- Oil cap and dipstick tube.
- Purge solenoid.
- MAP sensor.
- Brake booster.
- Intake manifold, crankcase, throttle body and EGR gaskets.

DTC P0102 - MAF SENSOR CIRCUIT LOW FREQUENCY

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Mass Airflow (MAF) sensor measures amount of air entering engine during a given time. VCM uses MAF sensor information for fuel delivery calculations. MAF sensor readings during acceleration are much higher than those during deceleration or idle.

VCM calculates what MAF sensor reading should be received from sensor under certain conditions using engine speed (RPM), throttle position, and altitude parameters. When these test conditions are met, VCM will compare its calculated MAF value to actual value received from sensor.

Condition required to set DTC:

- Engine running.
- Engine run time greater than .4 second.
- System voltage is at least 8 volts.
- Conditions must be present for a period of greater than zero seconds.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. After performing OBD system check, go to next step.
2. Start engine. With engine at idle, use scan tool to read MAF value. If MAF value is less than 2 grams per second, go to step 4). If value is 2 grams per second or greater, go to next step.
3. Turn engine off. Turn ignition on, engine off. Using scan tool, read and record FAIL RECORDS data. Operate vehicle within conditions noted in FAIL RECORD data. Using scan tool, read SPECIFIC DTC. If scan tool displays DTC P0102 FAILED THIS IGN, go to next step. If DTC P0102 FAILED THIS IGN

is not displayed, see DIAGNOSTIC AIDS.

4. Check for MAF sensor inlet screen blockage. Check for vacuum leaks at intake manifold, throttle body or EGR valve flange and pipes. Check for crankcase valve faulty, missing or incorrectly installed. Repair faulty conditions as necessary. After repairs, go to step 14). If no faulty conditions exist, go to next step.
5. Turn ignition off. Disconnect MAF sensor harness connector. Turn ignition on, engine off. Using a DVOM, check voltage between MAF sensor harness connector signal circuit and chassis ground. If voltage is about 5 volts, go next step. If voltage is not about 5 volts, go to step 9).
6. Connect a test light between MAF sensor harness connector ignition feed and ground circuits. If test light illuminates, go to step 8). If test light does not illuminate, go to next step.
7. Connect test light between MAF sensor harness connector ignition feed circuit and battery ground. If test light illuminates, go to step 10). If test light does not illuminate, go to step 11).
8. Check for faulty connection at MAF sensor. Repair connection as necessary. After repairs, go to step 14). If connection is okay, go to step 12).
9. Check MAF sensor signal circuit between VCM and MAF sensor for open or short. Repair signal circuit as necessary. After repairs, go to step 14). If signal circuit is okay, go to step 13).
10. Locate and repair open in the MAF sensor ground circuit. After repairs, go to step 14).
11. Locate and repair open MAF sensor ignition feed circuit. After repairs, go to step 14).
12. Replace MAF sensor. After replacing sensor, go to step 14).
13. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
14. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0102. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
15. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Ensure harness is not routed too close to high-voltage wires, such as spark plug cables. If connections and harness appear okay, observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

Check for vacuum leaks at following locations:

- Air inlet duct between MAF sensor and throttle body.
- "O" rings at fuel meter body.
- Oil cap and dipstick tube.
- Purge solenoid.
- MAP sensor.
- Brake booster.
- Intake manifold, crankcase, throttle body and EGR gaskets.

DTC P0103 - MAF SENSOR CIRCUIT HIGH FREQUENCY

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Mass Airflow (MAF) sensor measures amount of air entering engine during a given time. VCM uses MAF sensor information for fuel delivery calculations. MAF sensor readings during acceleration are much higher than those during deceleration or idle.

VCM calculates what MAF sensor reading should be received from sensor under certain conditions using engine speed (RPM), throttle position, and altitude parameters. When these test conditions are met, VCM will compare its calculated MAF value to actual value received from sensor.

Conditions for setting DTC:

- Engine running.
- Engine run time is at least .4 second.
- System voltage is at least 8 volts.
- MAF sensor is at least 10400 Hz.
- Conditions must be present for a period greater than zero seconds.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Start engine. With engine at idle, use scan tool to read MAF value. If MAF value is greater than 20 grams per second, go to step 4). If value is less than specified, go to next step.
3. Turn engine off. Turn ignition on, engine off. Using scan tool, read and record FAIL RECORDS data. Operate vehicle within conditions noted in FAIL RECORD data. Using scan tool, read SPECIFIC DTC. If scan tool displays DTC P0103 FAILED THIS IGN, go to next step. If scan tool does not display DTC P0103 FAILED THIS IGN, see DIAGNOSTIC AIDS.
4. Turn ignition off. Disconnect MAF sensor harness connector. Turn engine on and allow it to idle. Using scan tool, read MAF value. If value is about zero grams per second, go to next step. If value is not as specified, go to step 7).
5. Check for faulty connection at MAF sensor. Repair as necessary. After repairs, go to step 10). If connection is okay, go to next step.
6. Replace MAF sensor. After replacing sensor, go to step 10).
7. Ensure MAF sensor harness is not routed too close to high-voltage wires, such as spark plug cables, ignition coils or other high-voltage components. Reroute harness if necessary and go to step 10). If harness routing is okay, go to next step.
8. Check MAF sensor signal circuit connection at VCM. Repair as necessary. After repairs, go to step 10). If

connection is okay, go to next step.

9. Replace VCM. Program replacement PCM using required equipment. After replacing VCM, go to next step.
10. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0103. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
11. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Ensure harness is not routed too close to high-voltage wires, such as spark plug cables. If connections and harness appear okay, observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location. Check for vacuum leaks at following locations:

- Air inlet duct between MAF sensor and throttle body.
- "O" rings at fuel meter body.
- Oil cap and dipstick tube.
- Purge solenoid.
- MAP sensor.
- Brake booster.
- Intake manifold, crankcase, throttle body and EGR gaskets.

DTC P0106 - MAP SENSOR SYSTEM PERFORMANCE

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Manifold Absolute Pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). A 5-volt reference is applied to sensor. A variable resistor moves in relation to manifold pressure and a voltage signal is returned to VCM through MAP signal circuit. Voltage signal varies from 1.0-1.5 volts at closed throttle (high vacuum) to 4.0-4.5 volts at wide open throttle (low vacuum). A change in throttle position and engine speed should precede change in MAP. If change does not occur, MAP malfunction is present. VCM utilizes MAP signal and throttle position to determine fuel delivery.

Conditions for setting DTC are:

- No TP sensor related DTCs.
- Engine running.
- Engine speed changes less than 100 RPM.

- TP angle changes less than 1.95 percent.
- EGR flow changes less than 10 percent.
- Idle air changes less than 100 counts.
- No change in brake switch status.
- No change in clutch status (M/T).
- No change in A/C status.
- No change in power steering switch status.
- Conditions have stabilized for a period of 0.5 second.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Turn ignition on, engine off. Using scan tool, read MAP sensor voltage. Voltage should be 4.0-4.5 volts. If voltage varies 0.4 volt or greater from specification, go to next step. If voltage does not vary 0.4 volt or greater, go to step 6).
3. Disconnect and plug MAP sensor vacuum source. Connect a vacuum gauge to MAP sensor. Start engine. Using scan tool, read and record MAP sensor voltage. Observe and record MAP sensor voltage while applying 10 in. Hg If difference between first and second reading is 1.5 volts or greater, see DIAGNOSTIC AIDS. If difference is less than 1.5 volts, go to next step.
4. Check for faulty connection at MAF sensor. If faulty connection is found, go to next step. If connection is okay, go to step 6).
5. Repair connection as necessary. After repairs, go to step 7).
6. Replace MAP sensor. After replacing sensor, go to next step.
7. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0106. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
8. Using scan tool, select Read and Record INFO in REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check MAP sensor vacuum source for leaks, restrictions or faulty connections.

DTC P0107 - MAP SENSOR CIRCUIT LOW VOLTAGE

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Manifold Absolute Pressure (MAP) sensor measures changes in intake manifold pressure (vacuum). A low voltage signal, 1.0-1.5 volts, is sent to VCM on signal circuit at closed throttle (high vacuum). A high voltage signal, 4.0-4.5 volts is sent at wide open throttle (low vacuum).

Conditions required to set DTC are:

- No TP sensor related DTCs.
- Engine running.
- TP sensor is at least zero percent when engine speed is not greater than 1000 RPM.
- TP sensor is at least 10.1 percent when engine speed is greater than 1000 RPM.
- MAP voltage greater than 4.9 volts.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Start and warm engine to normal operating temperature. Allow engine to idle. Using scan tool, read MAP sensor voltage. If voltage is less than 0.5 volt, go to next step. If voltage is not less than 0.5 volt, go to step 5).
3. Turn ignition off. Disconnect MAP sensor harness connector. Connect a jumper wire between MAP sensor harness connector 5-volt reference circuit and signal circuit. Turn ignition on. If voltage is greater than 4.7 volts, go to step 6). If voltage is not greater than 4.7 volts, go to next step.
4. Turn ignition off. Remove jumper wire. Connect a test light between MAP sensor harness connector signal circuit and battery voltage. Turn ignition on. If voltage is greater than 4.7 volts, go to step 9). If voltage is not greater than 4.7 volts, go to step 7).
5. DTC P0107 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.
6. Check for faulty connection at MAP. If faulty connection is found, go to step 12). If connection is okay, go to step 11).
7. Check for open MAP sensor signal circuit. If open signal circuit is found, go to step 12). If no open signal circuit is found, go to next step.
8. Check MAP sensor signal circuit for short to ground. If short to ground in signal circuit is found, go to step 12). If no short to ground in signal circuit is found, go to step 13).
9. Check for open MAP sensor 5-volt reference circuit. If open 5-volt reference circuit is found, go to step 12). If no open 5-volt reference circuit is found, go to next step.
10. Check MAP sensor 5-volt reference circuit for short to ground. If short to ground in 5-volt reference circuit is found, go to step 12). If no short to ground in 5-volt reference circuit is found, go to step 13).
11. Replace MAP sensor. After replacing sensor, go to step 14).
12. Repair circuit as necessary. After repairs, go to step 14).
13. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
14. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating

temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0107. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

15. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check MAP sensor signal and 5-volt reference circuits for intermittent open condition. With ignition on and engine off, MAP signal is equal to atmospheric pressure with signal voltage high. This information is used by VCM as an indication of altitude. Comparison of this reading with a known-good vehicle with same sensor is a way to check accuracy of suspect sensor. Reading should be within 0.4 volt. Disconnect sensor from bracket and twist sensor by hand to check for intermittents. Output changes greater than 0.1 volt indicate a faulty sensor connection.

DTC P0108 - MAP SENSOR CIRCUIT HIGH VOLTAGE

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Manifold Absolute Pressure (MAP) sensor measures changes in intake manifold pressure (vacuum). A low voltage signal, 1.0-1.5 volts, is sent to VCM on signal circuit at closed throttle (high vacuum). A high voltage signal, 4.0-4.5 volts, is sent at wide open throttle (low vacuum).

Conditions for setting DTC:

- No TP sensor related DTCs are set.
- TP angle is not greater than 96.8 percent when engine speed is not greater than 1000 RPM.
- TP angle is not greater than 89.8 percent when engine speed is greater than 1000 RPM.
- MAP is greater than or equal to 4.9 volts.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Correct any engine idle or vacuum problems before proceeding. Turn engine on and allow it to idle. Using scan tool, read MAP sensor voltage. If voltage is less than 4 volts, go to next step. If voltage is not less than 4 volts, go to step 4).
3. Turn ignition off. Disconnect MAP sensor harness connector. Turn ignition on. If voltage is less than one volt, go to step 5). If voltage is not less than one volt, go to step 9).
4. DTC P0108 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, go to DIAGNOSTIC AIDS.

5. Using a DVOM connected to ground, probe 5-volt reference circuit at MAP sensor harness connector. If voltage reading is greater than 5.2 volts, go to step 10). If voltage reading is not greater than 5.2 volts, go to next step.
6. Using a test light connected battery voltage, probe MAP sensor ground circuit at MAP sensor harness connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 14).
7. Check MAP sensor vacuum source for restriction. If restriction is found, go to step 15). If no restriction is found, go to next step.
8. Replace MAP sensor. After replacing sensor, go to step 19).
9. Check for short to voltage in MAP sensor signal circuit. Repair as necessary. After repairs, go to step 15). If circuit is okay, go to step 18).
10. Turn ignition off. Disconnect VCM White harness connector. Turn ignition on. Using DVOM connected to ground, check voltage on 5-volt reference circuit at VCM harness connector. If voltage reading is greater than 5.2 volts, go to next step. If voltage reading is not greater than 5.2 volts, go to step 13).
11. Disconnect EGR harness connector. Check voltage on 5-volt reference circuit at VCM harness connector. If voltage reading is greater than 5.2 volts, go to next step. If voltage reading not greater than 5.2 volts, go to step 16).
12. Repair short to voltage on 5-volt reference circuit. After repairs, go to step 19).
13. Using DVOM connected to ground, check voltage on VCM harness connector terminal GR12. If voltage reading is greater than 5.2 volts, go to step 17). If voltage reading is not greater than 5.2 volts, go to step 18).
14. Repair sensor ground circuit. After repairs, go to step 19).
15. Repair as necessary. After repairs, go to step 19).
16. Replace EGR valve. After replacing EGR valve, go to step 19).
17. Repair short to ground on 5-volt reference circuit. After repairs, go to step 19).
18. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
19. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0108. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
20. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check MAP sensor signal and 5-volt reference circuits for intermittent open condition. With ignition on and engine off, MAP signal is equal to atmospheric pressure with signal voltage high. This information is used by VCM as an indication of altitude. Comparison of this reading with a known-good vehicle with same sensor is a way to check accuracy of suspect sensor. Readings should be within 0.4 volt of each other.

Disconnect sensor from bracket and twist sensor by hand to check for intermittents. Output changes greater than 0.1 volt indicate a faulty sensor connection.

DTC P0112 - IAT SENSOR CIRCUIT LOW VOLTAGE

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Intake Air Temperature (IAT) sensor is a thermistor that varies resistance based on temperature. As temperature of sensor increases, resistance decreases. High temperature will result in a low signal voltage. DTC will set when VCM sees an IAT sensor voltage of less than 0.82 volt for 10 seconds after engine runs for 100 seconds.

Conditions required to test for DTC are:

- Vehicle driven at 2 MPH or greater.
- No VSS DTCs are set.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Turn engine on and allow it to idle. Using scan tool, read IAT sensor voltage. If voltage is less than 0.82 volt, go to next step. If voltage is not less than 0.82 volt, go to step 5).
3. Turn engine off. Turn ignition on. Disconnect IAT sensor harness connector. If voltage is greater than 4 volts, go to step 7). If voltage is not greater than 4 volts, go to next step.
4. Turn ignition off. Using DVOM, check resistance across IAT sensor harness connector. If resistance is infinite, go to step 8). If resistance is not infinite, go to step 6).
5. DTC P0112 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.
6. Repair short to ground in IAT sensor signal circuit. After repairs, go to step 9).
7. Replace IAT sensor. After replacing sensor, go to step 9).
8. Replace VCM. Program replacement VCM using required equipment. After replacing and reprogramming VCM, go to next step.
9. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0112. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
10. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

If DTC P1112 is also set, problem is intermittent. Check for short to ground in IAT sensor harness connector signal circuit. Observe scan tool while moving all related harness and connectors. A change in scan tool display

indicates fault location. See **IAT TEMPERATURE-TO-RESISTANCE VALUES** .

IAT TEMPERATURE-TO-RESISTANCE VALUES

Temperature °F (°C)	Ohms
212 (100)	177
194 (90)	241
158 (70)	467
122 (50)	973
104 (40)	1459
86 (30)	2238
68 (20)	3520
50 (10)	5670

DTC P0113 - IAT SENSOR CIRCUIT HIGH VOLTAGE

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Intake Air Temperature (IAT) sensor is a thermistor that varies resistance based on temperature. As temperature of sensor increases, resistance decreases. Low temperature will result in a high signal voltage. DTC will set when VCM sees an IAT sensor voltage of greater than 5 volts.

Conditions required to set DTC are:

- No ECT sensor related DTCs.
- No VSS DTCs are set.
- No MAF sensor related DTCs.
- Vehicle speed is less than 2 MPH.
- MAF value is less than 250 grams per second.
- ECT is greater than 84.7°F (29.3°C).
- Engine run time is greater than 100 seconds.
- IAT voltage is greater than 4.9 volts.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Start engine and allow to idle. Using scan tool, read IAT sensor voltage. If voltage is greater than 4.9 volts, go to next step. If voltage is not greater than 4.9 volts, go to step 6).
3. Turn engine off. Turn ignition on. Disconnect IAT sensor harness connector. Connect a jumper wire

across IAT sensor harness connector. If voltage is less than 0.82 volt, go to step 7). If voltage is not less than 0.82 volt, go to next step.

4. Connect jumper wire between IAT sensor harness connector signal circuit and chassis ground. If voltage is less than 0.82 volt, go to step 8). If voltage is not less than 0.82 volt, go to next step.
5. If DTC P0123 is also set, go to **DTC P0123** . If DTC is not set, go to step 9).
6. DTC P0113 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.
7. Inspect VCM and IAT sensor for proper connection. If a problem is found, go to step 10). If connections are okay, go to step 11).
8. Check IAT sensor harness connector ground circuit for open between VCM and IAT sensor. If open is found, go to step 10). If open is not found, go to step 12).
9. Check IAT sensor harness connector signal circuit for open between VCM and IAT sensor. If open is found, go to next step. If open is not found, go to step 12).
10. Repair circuit as necessary. After repairs, go to step 13).
11. Replace IAT sensor. After replacing sensor, go to step 13).
12. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0113. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
14. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

If **DTC P1112** is also set, problem is intermittent. Check for short to ground in IAT sensor harness connector signal circuit. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location. Check for skewed IAT sensor. See the **IAT TEMPERATURE-TO-RESISTANCE VALUES** table.

DTC P0117 - ECT SENSOR CIRCUIT LOW VOLTAGE

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Engine Coolant Temperature (ECT) sensor is a thermistor that varies resistance based on temperature. As temperature of sensor increases, resistance decreases. High temperature will result in a low signal voltage. DTC will set when VCM sees an ECT sensor voltage of less than 0.82 volt for 10 seconds after engine runs for 100 seconds.

Condition for setting DTC:

- Engine run time is greater than 5 seconds.
- Signal voltage is less than .25 volt for 5 seconds.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Turn engine on and allow it to idle. Using scan tool, read ECT sensor voltage. If voltage is less than 0.82 volt, go to next step. If voltage is not less than 0.82 volt, go to step 5).
3. Turn engine off. Turn ignition on. Disconnect ECT sensor harness connector. If voltage is greater than 4 volts, go to step 7). If voltage is not greater than 4 volts, go to next step.
4. Turn ignition off. Using DVOM, check resistance across ECT sensor harness connector. If resistance is infinite, go to step 8). If resistance is not infinite, go to step 6).
5. DTC P0117 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.
6. Repair short to ground in ECT sensor signal circuit. After repairs, go to step 9).
7. Replace ECT sensor. After replacing sensor, go to step 9).
8. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
9. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0117. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
10. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for short to ground in ECT sensor harness connector 5-volt reference circuit. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

Check for skewed ECT sensor. See **ECT TEMPERATURE-TO-RESISTANCE VALUES** .

ECT TEMPERATURE-TO-RESISTANCE VALUES

Temperature °F (°C)	Ohms
212 (100)	177
194 (90)	241
158 (70)	467
122 (50)	973
104 (40)	1459
86 (30)	2238
68 (20)	3520

DTC P0118 - ECT SENSOR CIRCUIT HIGH VOLTAGE

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Engine Coolant Temperature (ECT) sensor is a thermistor that varies resistance based on temperature. As temperature of sensor increases, resistance decreases. Low temperature will result in a high signal voltage. DTC will set when VCM sees an ECT sensor voltage of greater than 5 volts.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Start engine and allow it to idle. Using scan tool, read ECT sensor voltage. If voltage is greater than 4.9 volts, go to next step. If voltage is not greater than 4.9 volts, go to step 5).
3. Turn engine off. Turn ignition on. Disconnect ECT sensor harness connector. Connect a jumper wire across ECT sensor harness connector. If voltage is less than 0.82 volt, go to step 6). If voltage is not less than 0.82 volt, go to next step.
4. Connect jumper wire between ECT sensor harness connector signal circuit and chassis ground. If voltage is less than 0.82 volt, go to step 7). If voltage is not less than 0.82 volt, go to step 8).
5. DTC P0118 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, go to DIAGNOSTIC AIDS.
6. Inspect VCM and ECT sensor for proper connection. If a problem is found, go to step 10). If connections are okay, go to step 11).
7. Check ECT sensor harness connector ground circuit for open between VCM and ECT sensor. If open is found, go to step 10). If open is not found, go to step 12).
8. If **DTC P0123** is also set, go to DTC P0123. If DTC is not set, go to next step.
9. Check ECT sensor harness connector signal circuit for open between VCM and ECT sensor. If open is found, go to next step. If open is not found, go to step 12).
10. Repair circuit as necessary. After repairs, go to step 13).
11. Replace ECT sensor. After replacing sensor, go to step 13).
12. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0118. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
14. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are

displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or open in 5-volt reference and ground circuits. Check for skewed ECT sensor. See **ECT TEMPERATURE-TO-RESISTANCE VALUES** .

DTC P0121 - TP SENSOR SYSTEM PERFORMANCE

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Throttle Position (TP) sensor measures amount of throttle opening. VCM uses TP sensor information for fuel delivery calculations. TP sensor readings during acceleration are much higher than those during deceleration or idle.

TP sensor signal is one of the most important inputs used by the VCM for fuel control and for most of the VCM control inputs.

Conditions required for setting DTC:

- No MAP related DTCs are present.
- No TP related DTCs are present.
- No IAT related DTCs are present.
- Engine is running.
- BARO is not at calculated default.
- Change in TP is less than 1.9 percent.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Turn ignition on, engine off. Using scan tool, read TP ANGLE value. If value is greater than 2 percent, go to step 4). If value is not greater than 2 percent, go to next step.
3. Observe scan tool while moving throttle from closed to wide open, and closed again. If TP ANGLE value is greater than 2 percent, go to next step. If value is 2 percent or less, go to step 5).
4. Disconnect TP sensor harness connector. If TP ANGLE value is zero percent, go to step 6). If value is not zero percent, go to step 9).
5. DTC P0121 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, go to DIAGNOSTIC AIDS.
6. Check for faulty connection at TP sensor. Repair connection as necessary. After repairs, go to next step.

If connection is okay, go to step 8).

7. Repair circuit as necessary. After repairs, go to step 10).
8. Replace TP sensor. After replacing sensor, go to step 10).
9. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
10. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0121. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
11. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for and repair the following condition(s):

- Throttle plate sticking or excessive deposits on throttle plate or throttle bore.
- Check TP sensor harness connector terminals for damage.
- A steady throttle movement from a stop should cause TP ANGLE value reading on scan tool to increase smoothly as throttle is opened.

DTC P0122 - TP SENSOR CIRCUIT LOW VOLTAGE

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Throttle Position (TP) sensor measures amount of throttle opening. VCM uses TP sensor information for fuel delivery calculations. TP sensor readings during acceleration are much higher than those during deceleration or idle.

Condition required for setting this DTC:

- Engine running.
- TP sensor voltage less than .25 volt.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. With throttle closed, use scan tool to read TP signal voltage. If voltage is less than 0.15 volt, go to next step. If voltage is not less than 0.15 volt, go to step 5).

3. Disconnect TP sensor harness connector. Connect a jumper wire between TP sensor harness connector sensor signal and 5-volt reference circuits. If voltage is greater than 4 volts, go to step 13). If voltage is not greater than 4 volts, go to next step.
4. Connect a test light between TP sensor harness connector signal circuit and battery voltage. If scan tool reading is greater than 4 volts, go to step 6). If scan tool reading is not greater than 4 volts, go to step 8).
5. DTC P0122 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.
6. Check for open in TP sensor harness connector 5-volt reference circuit. If circuit is open, go to step 11). If circuit is okay, go to next step.
7. Check for short to ground in TP sensor harness connector 5-volt reference circuit. If circuit is shorted, go to step 11). If circuit is okay, go to step 10).
8. Check for open in TP sensor harness connector signal circuit. If circuit is open, go to step 11). If circuit is okay, go to next step.
9. Check for short to ground in TP sensor harness connector signal circuit. If circuit is shorted, go to step 11). If circuit is okay, go to next step.
10. Check for faulty connection at VCM. If faulty connection is found, go to next step. If connection is okay, go to step 13).
11. Repair circuit as necessary. After repairs, go to step 14).
12. Replace TP sensor. After replacing sensor, go to step 14).
13. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
14. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0122. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
15. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for and repair the following condition(s):

- Throttle plate sticking or excessive deposits on throttle plate or throttle bore.
- Check TP sensor harness connector 5-volt reference circuit for open or short to ground, and repair as necessary.
- TP signal voltage reading on scan tool should be less than 1.25 volt with throttle closed, and greater than 4.5 volts at wide open throttle.

DTC P0123 - TP SENSOR CIRCUIT HIGH VOLTAGE

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Throttle Position (TP) sensor measures amount of throttle opening. VCM uses TP sensor information for fuel delivery calculations. TP sensor readings during acceleration are much higher than those during deceleration or idle.

Condition required for setting DTC:

- Engine running.
- TP sensor signal voltage is greater than 4.7 volts.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. With throttle closed, use scan tool to read TP signal voltage. If voltage is greater than 4.8 volts, go to next step. If voltage is not greater than 4.8 volts, go to step 4).
3. Turn ignition off. Disconnect TP sensor harness connector. Turn ignition on. Using scan tool check TP sensor voltage reading. If voltage reading is less than 0.2 volt, go to step 5). If voltage is not less than 0.2 volt, go to step 8).
4. DTC P0123 is intermittent. If no additional DTC(s) are present, see DIAGNOSTIC AIDS. If other DTC (s) are present, diagnose affected DTC(s).
5. Using DVOM connected to ground, probe 5-volt reference circuit at TP sensor harness connector. If voltage reading is greater than 5.2 volts, go to step 9). If voltage reading is not greater than 5.2 volts, go to next step.
6. Using a test light connected to battery voltage, probe TP sensor ground circuit at TP sensor harness connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 13).
7. Replace TP sensor. After replacing sensor, go to step 18).
8. Check for short to voltage on TP sensor signal circuit. Repair as necessary. After repairs, go to step 14). If circuit is okay, go to step 17).
9. Turn ignition off. Disconnect VCM White harness connector. Turn ignition on. Using DVOM connected to ground, check voltage on the 5-volt reference circuit at the VCM harness connector. If voltage reading is greater than 5.2 volts, go to step 12). If voltage reading is not greater than 5.2 volts, go to next step.
10. Check voltage between ground and 5-volt reference circuit at VCM harness connector. If voltage reading is greater than 5.2 volts, go to next step. If voltage reading is not greater than 5.2 volts, go to step 17).
11. Disconnect EGR harness connector. Check voltage on 5-volt reference circuit at VCM harness connector. If voltage reading is greater than 5.2 volts, go to step 16). If voltage reading is not greater than 5.2 volts, go to step 15).
12. Repair short to voltage on the 5-volt reference circuit. After repairs, go to step 18).
13. Check for open in sensor ground circuit. If circuit is open, go to next step. If circuit is okay, go to step 17).
14. Repair as necessary. After repairs, go to step 18).

15. Replace EGR valve. After replacing EGR, go to step 18).
16. Repair short to voltage on 5-volt reference circuit. After repairs, go to step 18).
17. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
18. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0123. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
19. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for and repair the following condition(s):

- Throttle plate sticking or excessive deposits on throttle plate or throttle bore.
- Check TP sensor harness connector ground circuit for open, and signal circuit for short to ground.
- TP sensor signal voltage should be less than 1.25 volt with throttle closed, and greater than 4.5 volts at wide open throttle.

DTC P0125 - ECT EXCESSIVE TIME TO REACH CLOSED LOOP

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

While engine is warming, VCM reads Engine Coolant Temperature (ECT) sensor to determine how long it takes coolant to reach temperature required for closed loop operation. VCM compares actual time required to a predetermined time.

Conditions required to set DTC are:

- Engine running.
- No ECT or IAT DTCs are set.
- Vehicle speed greater than one MPH.
- ECT and IAT greater than 15.8°F (-9°C).
- Start-up ECT is greater than 15.8°F (-9°C).

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Allow engine to cool completely. Turn ignition on. Using scan tool, compare ECT and IAT values. If values are close, go to next step. If values are not close, go to **DTC P0117** .

3. Check coolant level. If coolant level is low, diagnose cooling system. If coolant level is okay, go to next step.
4. While reading scan tool, start and warm engine to normal operating temperature. If ECT value rises steadily to greater than 95°F (35°C) within 9 minutes, see DIAGNOSTIC AIDS. If ECT value does not rise as specified, go to next step.
5. Compare actual coolant temperature with scan tool ECT value. If temperatures are close, repair cooling system as necessary. If temperatures are not close, go to next step.
6. Replace ECT sensor. After replacing sensor, go to next step.
7. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0125. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
8. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Ensure thermostat is operating properly. Check for faulty connections or damaged harness. If connections and harness appear okay, observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

Check for skewed ECT sensor. See **ECT TEMPERATURE-TO-RESISTANCE VALUES** .

DTC P0131 - HO2S CIRCUIT LOW VOLTAGE SENSOR 1

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions required to test for DTC are:

- No ECT, IAT, MAF, MAP or TP sensor DTCs set.
- No EVAP system DTC set.
- No other DTC tests in progress.
- No device controls active.
- System voltage measures at least 9 volts.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Start engine and allow it to reach operating temperature. Place gear selector in Park or Neutral, and apply parking brake. Increase engine speed to 1200 RPM. Using scan tool, read HO2S BANK 1, SENSOR 1 voltage. If voltage is less than 0.086 volt, go to next step. If voltage is not less than 0.086 volt, go to step 4).
3. Turn ignition off. Disconnect HO2S connector. Connect a jumper wire between HO2S harness connector ground circuit and chassis ground. Turn ignition on, engine off. If voltage is 0.35-0.55 volt, go to step 7). If voltage is not as specified, go to step 5).
4. DTC P0131 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.
5. Check HO2S sensor harness connector signal circuit for short to ground. If short is found, go to next step. If circuit is okay, go to step 8).
6. Repair circuit as necessary. After repairs, go to step 9).
7. See DIAGNOSTIC AIDS.
8. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
9. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0131. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
10. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Using scan tool, observe LT FUEL TRIM values at different RPM. If conditions to set DTC 1031 exist, value should be about 158 or greater. Check for an intermittent short to ground in HO2S signal circuit. Never solder HO2S wires. Check for fuel contamination. Check for proper fuel pressure. Check for exhaust leaks.

DTC P0132 - HO2S CIRCUIT HIGH VOLTAGE BANK 1, SENSOR 1

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions required to test for DTC are:

- No ECT, IAT, MAF, MAP or TP sensor DTCs set.
- No EVAP system DTC set.
- No other DTC tests in progress.
- No device controls active.
- System voltage measures at least 9 volts.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Start engine and allow it to reach operating temperature. Place gear selector in Park or Neutral, and apply parking brake. Increase engine speed to 1200 RPM. Using scan tool, read HO2S BANK 1, SENSOR 1 voltage. If voltage is greater than 0.976 volt, go to next step. If voltage is not greater than 0.976 volt, go to step 4).
3. Turn ignition off. Disconnect HO2S connector. Connect a jumper wire between HO2S harness connector signal and ground circuits, and chassis ground. Turn ignition on, engine off. If voltage is less than 0.2 volt, go to step 5). If voltage is not less than 0.2 volt, go to step 6).
4. DTC P0132 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.
5. See DIAGNOSTIC AIDS.
6. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
7. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0132. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
8. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for proper fuel pressure. Check for proper fuel injector operation. Check EVAP canister for fuel saturation. Check for leaking fuel pressure regulator diaphragm. Check for proper TP sensor operation. Check HO2S for silicon contamination (powdery white deposit). Using scan tool, check HO2S voltage. Voltage should be greater than one volt. Check HO2S voltage with connector disconnected. If voltage goes from greater than one volt to about 0.45 volt, replace HO2S. Never solder HO2S wires.

DTC P0133 - HO2S SLOW RESPONSE BANK 1, SENSOR 1

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions required to test for DTC are:

- No ECT, IAT, MAF, MAP or TP sensor DTCs set.
- No EVAP system DTC set.
- No other DTC tests in progress.
- No device controls are active.
- System voltage measures at least 9 volts.
- HO2S average transition time from lean-to-rich and rich-to -lean is greater than 100 milliseconds.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. If any other HO2S DTCs are set, diagnose affected DTCs. If no other HO2S DTCs are set, go to next step.
3. Using scan tool, read MAP sensor voltage, with engine idling. If voltage is greater than 4 volts, see **DTC P0108** . If voltage is not greater than 4 volts, go to next step.
4. Visually inspect exhaust system for leaks near HO2S. If leaks are found, go to step 8). If no leaks are found, go to next step.
5. Visually inspect HO2S for secure installation. If HO2S is not securely installed, go to step 8). If HO2S is securely installed, go to next step.
6. Ensure HO2S connector and harness are not contacting engine or exhaust system. If connector or harness are contacting engine or exhaust system, go to step 8). If connector and harness are okay, go to next step.
7. Check HO2S for silicon (powdery white) deposit, engine oil or coolant contamination. If contamination exists, go to step 9). If no contamination exists, see DIAGNOSTIC AIDS.
8. Repair as necessary. After repairs, go to step 11).
9. Repair source of contamination. After repairs, go to step 11).
10. Replace HO2S. After replacing sensor, go to next step.
11. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0133. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
12. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check HO2S Heater operation. Never solder HO2S wires.

DTC P0134 - HO2S INSUFFICIENT ACTIVITY BANK 1, SENSOR 1

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions required to test for DTC are:

- No ECT, IAT, MAF, MAP or TP sensor DTCs set.
- No EVAP system DTC set.
- No other DTC tests in progress.
- No device controls active.
- System voltage measures at least 9 volts.
- Engine run time is at least 2 minutes.
- HO2S voltage is greater than .299 volts but less than .598 volts.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Start engine and allow it to reach operating temperature. Place gear selector in Park or Neutral, and apply parking brake. Increase engine speed to greater than 1200 RPM for 2 minutes. Using scan tool, read LOOP MODE. If scan tool displays CLOSED LOOP, go to step 5). If scan tool does not display CLOSED LOOP, go to next step.
3. Turn ignition off. Disconnect HO2S connector. Connect a jumper wire between HO2S harness connector signal and ground circuits, and chassis ground. Turn ignition on, engine off. If voltage is less than 0.2 volt, go to step 7). If voltage is less than 0.2 volt, go to next step.
4. Remove jumper wire. Turn ignition off. Reconnect HO2S connector. Disconnect Blue VCM connector. Connect a test light between Blue VCM harness connector signal circuit and battery voltage. If test light illuminates, go to step 6). If test light does not illuminate, go to step 9).
5. DTC P0134 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.
6. Check HO2S harness connector signal circuit for open. If open is found, go to step 11). If no open is found, go to step 8).
7. Check HO2S for faulty connection. If faulty connection is found, go to step 11). If connection is okay, go

to step 10).

8. Check VCM for faulty connection. If faulty connection is found, go to step 11). If faulty connection is not found, go to step 12).
9. Repair open ground circuit. After repairs, go to step 13).
10. Replace HO2S. After replacing sensor, go to step 13).
11. Repair circuit as necessary. After repairs, go to step 13).
12. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0134. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
14. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Check for faulty HO2S heater. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P0135 - HO2S HEATER CIRCUIT BANK 1, SENSOR 1

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. When ignition is turned on, battery voltage is supplied to HO2S heater to provide for faster sensor warm-up, thus allowing sensor to become active in a shorter period of time. VCM reads amount of time necessary for sensor to become active after start-up.

Conditions required to set DTC are:

- MAF less than 27 grams per second.
- Engine running greater than 2 seconds.
- ECT and IAT less than 89.6°F (32°C).
- Difference between ECT and IAT no greater than 41°F (5°C).
- Elapsed time HO2S bias voltage is greater than predetermined value.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L**

article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

NOTE: If engine has been operating, allow engine to cool for about 1 hour before proceeding with tests.

2. Turn ignition off. Turn ignition, engine off. Using scan tool, read HO2S voltage. If voltage gradually decreases 0.15 volt, go to step 5). If voltage does not decrease as indicated, go to next step.
3. Disconnect HO2S harness connector. Connect a test light between chassis ground and ignition feed circuit at HO2S. If test light illuminates, go to next step. If test light does not illuminate, go to step 6).
4. Connect test light between ignition feed and heater ground circuits at HO2S harness connector. If test light illuminates, go to step 7). If test light does not illuminate, go to step 8).
5. DTC P0135 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.
6. Check HO2S (bank 1 sensor 1) fuse. If fuse is open, go to step 14. If fuse is okay, go to step 9).
7. Check HO2S for faulty connection. If faulty connection is found, go to step 12). If connection is okay, go to step 15).
8. Check HO2S for faulty connection. If faulty connection is found, go to step 12). If connection is okay, go to step 10).
9. Check HO2S for faulty connection. If faulty connection is found, go to step 12). If connection is okay, go to step 11).
10. Repair open HO2S ground circuit. After repairs, go to step 16).
11. Check for open HO2S harness connector ignition feed circuit. After repairs, go to step 13).
12. Repair faulty connection. After repairs, go to step 16).
13. Repair open HO2S ignition feed circuit. After repairs, go to step 16).
14. Repair short to ground in HO2S ignition feed circuit, replace fuse and go to step 16)
15. Replace HO2S. After replacing sensor, go to next step.
16. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0135. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
17. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Never solder HO2S wires.

DTC P0137 - HO2S CIRCUIT LOW VOLTAGE BANK 1, SENSOR 2

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions required to test for DTC are:

- No ECT, IAT, MAF, MAP or TP sensor DTCs set.
- No EVAP system DTC set.
- No other DTC tests in progress.
- No device control active.
- System voltage measures at least 9 volts.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Start engine and allow it to reach operating temperature. Place gear selector in Park or Neutral, and apply parking brake. Increase engine speed to 1200 RPM. Using scan tool, read HO2S BANK 2, SENSOR 1 voltage. If voltage is less than 0.086 volt, go to next step. If voltage is not less than 0.086 volt, go to step 4).
3. Turn ignition off. Disconnect HO2S connector. Connect a jumper wire between HO2S harness connector ground circuit and chassis ground. Turn ignition on, engine off. If voltage is 0.35-0.55 volt, go to step 7). If voltage is not as specified, go to step 5).
4. DTC P0137 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.
5. Check HO2S sensor harness connector signal circuit for short to ground. If short is found, go to next step. If circuit is okay, go to step 8).
6. Repair circuit as necessary. After repairs, go to step 9).
7. See DIAGNOSTIC AIDS.
8. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
9. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0137. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
10. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Using scan tool, observe LT FUEL TRIM values at different RPM. If conditions to set DTC P0137 exist, value should be about 158 or greater. Check for an intermittent short to ground in HO2S signal circuit. Never solder HO2S wires. Check for fuel contamination. Check for proper fuel pressure. Check for exhaust leaks.

DTC P0138 - HO2S CIRCUIT HIGH VOLTAGE BANK 1, SENSOR 2

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions required to test for DTC are:

- No ECT, IAT, MAF, MAP or TP sensor DTCs set.
- No EVAP system DTC set.
- No other DTC tests in progress.
- No device controls active.
- System voltage measures at least 9 volts.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Start engine and allow it to reach operating temperature. Place gear selector in Park or Neutral, and apply parking brake. Increase engine speed to 1200 RPM. Using scan tool, read HO2S BANK 1, SENSOR 2 voltage. If voltage is greater than 976 mV, go to next step. If voltage is not greater 976 mV, go to step 4).
3. Turn ignition off. Disconnect HO2S connector. Connect a jumper wire between HO2S harness connector signal and ground circuits, and chassis ground. Turn ignition on, engine off. If voltage is less than 0.2 volt, go to step 5). If voltage is not less than 0.2 volt, go to step 6).
4. DTC P0138 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.
5. Go to DIAGNOSTIC AIDS.
6. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
7. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0138. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

8. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for proper fuel pressure. Check for proper fuel injector operation. Check EVAP canister for fuel saturation. Check for leaking fuel pressure regulator diaphragm. Check for proper TP sensor operation. Check HO2S for silicone contamination (powdery white deposit). Using scan tool, check HO2S voltage. Voltage should be greater than one volt. Check HO2S voltage with connector disconnected. If voltage goes from greater than one volt to about 0.45 volt, replace HO2S. Never solder HO2S wires.

DTC P0140 - HO2S INSUFFICIENT ACTIVITY BANK 1, SENSOR 2

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions required to test for DTC are:

- No ECT, IAT, MAF, MAP or TP sensor DTCs set.
- No EVAP system DTC set.
- No other DTC tests in progress.
- No device controls active.
- System voltage measures at least 9 volts.
- Engine run time at least 2 minutes.
- HO2S voltage is greater than .299 volt, but less than .598 volt.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Start engine and allow it to reach operating temperature. Place gear selector in Park or Neutral, and apply parking brake. Increase engine speed to greater than 1200 RPM for 2 minutes. Using scan tool, read LOOP MODE. If scan tool displays CLOSED LOOP, go to step 5). If scan tool does not display CLOSED LOOP, go to next step.
3. Turn ignition off. Disconnect HO2S connector. Connect a jumper wire between HO2S harness connector signal and ground circuits, and chassis ground. Turn ignition on, engine off. Read HO2S BANK 1 SENSOR GROUND voltage. If voltage is less than 0.2 volt, go to step 7). If voltage is 0.2 volt or greater,

go to next step.

4. Remove jumper wire. Turn ignition off. Reconnect HO2S connector. Disconnect Blue VCM connector. Connect a test light between Blue VCM harness connector signal circuit and battery voltage. If test light illuminates, go to step 6). If test light does not illuminate, go to step 9).
5. DTC P0140 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.
6. Check HO2S harness connector signal circuit for open. If open is found, go to step 11). If no open is found, go to step 8).
7. Check HO2S for faulty connection. If faulty connection is found, go to step 11). If connection is okay, go to step 10).
8. Check VCM for faulty connection. If faulty connection is found, go to step 11). If faulty connection is not found, go to step 12).
9. Repair open ground circuit. After repairs, go to step 13).
10. Replace HO2S. After replacing sensor, go to step 13).
11. Repair circuit as necessary. After repairs, go to step 13).
12. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0140. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
14. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Check for faulty HO2S heater. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P0141 - HO2S HEATER CIRCUIT BANK 1, SENSOR 2

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. When ignition is turned on, battery voltage is supplied to HO2S heater to provide for faster sensor warm-up, thus allowing sensor to become active in a shorter period of time. VCM reads amount of time necessary for sensor to become active after start-up.

Conditions required to set DTC are:

- MAF less than 27 grams per second.
- Engine running greater than 2 seconds.
- ECT and IAT less than 89.6°F (32°C).
- Difference between ECT and IAT no greater than 41°F (5°C).
- Elapsed time HO2S bias voltage is greater than predetermined value.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

NOTE: If engine has been operating, allow engine to cool for about one hour before proceeding with tests.

2. Turn ignition off. Turn ignition, engine off. Using scan tool, read HO2S BANK 1, SENSOR 2 voltage. If voltage gradually decreases 0.3 volt, go to step 5). If voltage does not decrease, go to next step.
3. Disconnect HO2S harness connector. Connect test light to chassis ground and probe ignition feed circuit at HO2S harness connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 6).
4. Connect test light between ignition feed and heater ground circuits at HO2S harness connector. If test light illuminates, go to step 7). If test light does not illuminate, go to step 8).
5. DTC P0141 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.
6. Check HO2S (bank 1 sensor 2) fuse. If fuse is open, go to step 14). If fuse is okay, go to step 9).
7. Check HO2S for faulty connection. If faulty connection is found, go to step 12). If connection is okay, go to step 15).
8. Check HO2S for faulty connection. If faulty connection is found, go to step 12). If connection is okay, go to step 10).
9. Check HO2S for faulty connection. If faulty connection is found, go to step 12). If connection is okay, go to step 11).
10. Repair open HO2S ground circuit. After repairs, go to step 16).
11. Check for open HO2S harness connector ignition feed circuit. After repairs, go to step 13).
12. Repair faulty connection. After repairs, go to step 16).
13. Repair open HO2S ignition feed circuit. After repairs, go to step 16).
14. Repair short to ground in HO2S ignition feed circuit. After repairs, go to step 16)
15. Replace HO2S. After replacing sensor, go to next step.
16. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0141. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
17. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are

displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Never solder HO2S wires.

DTC P0143 - HO2S CIRCUIT LOW VOLTAGE BANK 1, SENSOR 3

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions required to test for DTC are:

- No ECT, IAT, MAF, MAP or TP sensor DTCs set.
- No EVAP system DTC set.
- No other DTC tests in progress.
- No device controls active.
- System voltage measures at least 9 volts.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Start engine and allow it to reach operating temperature. Place gear selector in Park or Neutral, and apply parking brake. Increase engine speed to 1200 RPM. Using scan tool, read HO2S BANK 1, SENSOR 3 voltage. If voltage is less than 0.26 volt, go to next step. If voltage is not less than 0.26 volt, go to step 4).
3. Turn ignition off. Disconnect HO2S connector. Connect a jumper wire between HO2S harness connector ground circuit and chassis ground. Turn ignition on, engine off. If voltage is 0.35-0.55 volt, see DIAGNOSTIC AIDS. If voltage is not as specified, go to step 5).
4. DTC P0143 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.
5. Check HO2S sensor harness connector signal circuit for short to ground. If circuit is shorted, go to next step. If circuit is okay, go to step 7).
6. Repair circuit as necessary. After repairs, go to step 8).
7. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.

8. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0143. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
9. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Using scan tool, observe LT FUEL TRIM values at different RPM. If conditions to set DTC 1043 exist, value should be about 158 or greater. Check for an intermittent short to ground in HO2S signal circuit. Never solder HO2S wires. Check for fuel contamination. Check for proper fuel pressure. Check for exhaust leaks.

DTC P0144 - HO2S CIRCUIT HIGH VOLTAGE BANK 1, SENSOR 3

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions required to test for DTC are:

- No ECT, IAT, MAF, MAP or TP sensor DTCs set.
- No EVAP system DTC set.
- No other DTC tests in progress.
- No device controls active.
- System voltage measures at least 9 volts.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Start engine and allow it to reach operating temperature. Place gear selector in Park or Neutral, and apply parking brake. Increase engine speed to 1200 RPM. Using scan tool, read HO2S BANK 1, SENSOR 3 voltage. If voltage is greater than 0.976 volt, go to next step. If voltage is not greater than 0.976, go to step 4).
3. Turn ignition off. Disconnect HO2S connector. Connect a jumper wire between HO2S harness connector signal and ground circuits, and chassis ground. Turn ignition on, engine off. If voltage is less than 0.2 volt, see DIAGNOSTIC AIDS. If voltage is not less than 0.2 volt, go to step 5).

4. DTC P0144 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.
5. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
6. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0144. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
7. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for proper fuel pressure. Check for proper fuel injector operation. Check EVAP canister for fuel saturation. Check for leaking fuel pressure regulator diaphragm. Check for proper TP sensor operation. Check HO2S for silicone contamination (powdery white deposit). Using scan tool, check HO2S voltage. Voltage should be greater than one volt. Check HO2S voltage with connector disconnected. If voltage goes from greater than one volt to about 0.45 volt, replace HO2S. Never solder HO2S wires.

DTC P0146 - HO2S INSUFFICIENT ACTIVITY BANK 1, SENSOR 3

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions required to test for DTC are:

- No ECT, IAT, MAF, MAP or TP sensor DTCs set.
- No EVAP system DTC set.
- No other DTC tests in progress.
- No device controls active.
- System voltage measures at least 9 volts.
- HO2S voltage is greater than .351 volts, but less than .473 volts.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2. If any other DTCs are set, diagnose affected DTC. If no other DTCs are set, go to next step.
3. Start engine and allow it idle. Using scan tool, read MAP sensor voltage. If voltage is greater than 4 volts, see **DTC P0108** . If voltage is not greater than 4 volts, go to next step.
4. Visually inspect exhaust system near HO2S (bank 1 sensor 1) for leaks. If leaks are found, go to step 8). If no leaks are found, go to next step.
5. Check if HO2S (bank 1 sensor 3) is installed securely. If HO2S is not installed securely, go to Step 8). If HO2S is installed securely, go to next step.
6. Ensure HO2S connector and harness are not contacting engine or exhaust system. If connector or harness are contacting engine or exhaust system, go to step 8). If connector and harness are okay, go to next step.
7. Check HO2S for silicone (powdery white) deposit, engine oil or coolant contamination. If contamination exists, go to step 9). If no contamination exists, see DIAGNOSTIC AIDS.
8. Repair as necessary. After repairs, go to step 11).
9. Repair source of contamination. After repairs, go to step 11).
10. Replace HO2S. After replacing sensor, go to next step.
11. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0146. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
12. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check HO2S Heater operation. Never solder HO2S wires.

DTC P0147 - HO2S HEATER CIRCUIT BANK 1, SENSOR 3

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. When ignition is turned on, battery voltage is supplied to HO2S heater to provide for faster sensor warm-up, thus allowing sensor to become active in a shorter period of time. VCM reads amount of time necessary for sensor to become active after start-up.

Conditions required to set DTC are:

- MAF less than 27 grams per second.
- Engine running greater than 2 seconds.
- ECT and IAT less than 89.6°F (32°C).

- Difference between ECT and IAT no greater than 41°F (5°C).
- Elapsed time HO2S bias voltage is greater than predetermined value.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

NOTE: If engine has been operating, allow engine to cool for about one hour before proceeding with tests.

2. Turn ignition off. Turn ignition, engine off. Using scan tool, read HO2S voltage. If voltage gradually decreases 0.15 volt, go to step 5). If voltage does not decrease, go to next step.
3. Disconnect HO2S harness connector. Connect a test light between chassis ground and ignition feed circuit at HO2S. If test light illuminates, go to next step. If test light does not illuminate, go to step 6).
4. Connect test light between ignition feed and heater ground circuits at HO2S harness connector. If test light illuminates, go to step 7). If test light does not illuminate, go to step 8).
5. DTC P0147 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.
6. Check HO2S (bank 1 sensor 3) fuse. If fuse is open, go to step 14). If fuse is okay, go to step 9).
7. Check HO2S for faulty connection. If faulty connection is found, go to step 12). If connection is okay, go to step 15).
8. Check HO2S for faulty connection. If faulty connection is found, go to step 12). If connection is okay, go to step 10).
9. Check HO2S for faulty connection. If faulty connection is found, go to step 12). If connection is okay, go to step 11).
10. Repair open HO2S ground circuit. After repairs, go to step 16).
11. Check for open HO2S harness connector ignition feed circuit. After repairs, go to step 13).
12. Repair faulty connection. After repairs, go to step 16).
13. Repair open HO2S ignition feed circuit. After repairs, go to step 16).
14. Repair short to ground in HO2S ignition feed circuit. After repairs, go to step 16)
15. Replace HO2S. After replacing sensor, go to next step.
16. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0147. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
17. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Never solder HO2S wires.

DTC P0151 - HO2S CIRCUIT LOW VOLTAGE BANK 2, SENSOR 1

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions for setting DTCs:

- No ECT, IAT, MAF, MAP or TP sensor DTCs set.
- No EVAP system DTC set.
- No other DTC tests in progress.
- No device controls active.
- System voltage measures at least 9 volts.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Start engine and allow it to reach operating temperature. Place gear selector in Park or Neutral, and apply parking brake. Increase engine speed to 1200 RPM. Using scan tool, read HO2S BANK 2, SENSOR 1 voltage. If voltage is less than 0.086 volt, go to next step. If voltage is not less than 0.086 volt, go to step 4).
3. Turn ignition off. Disconnect HO2S connector. Connect a jumper wire between HO2S harness connector ground circuit and chassis ground. Turn ignition on, engine off. If voltage is 0.35-0.55 volt, go to Step 7). If voltage is not as specified, go to step 5).
4. DTC P0151 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.
5. Check HO2S sensor harness connector signal circuit for short to ground. If circuit is shorted, go to next step. If circuit is okay, go to step 8).
6. Repair circuit as necessary. After repairs, go to step 9).
7. Go to DIAGNOSTIC AIDS.
8. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
9. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0151. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

10. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Using scan tool, observe LT FUEL TRIM values at different RPM. If conditions to set DTC 1051 exist, value should be about 158 or more. Check for an intermittent short to ground in HO2S signal circuit. Never solder HO2S wires. Check for fuel contamination. Check for proper fuel pressure. Check for exhaust leaks.

DTC P0152 - HO2S CIRCUIT HIGH VOLTAGE BANK 2, SENSOR 1

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions required to test for DTC are:

- No ECT, IAT, MAF, MAP or TP sensor DTCs set.
- No EVAP system DTC set.
- No other DTC tests in progress.
- No device controls active.
- System voltage measures at least 9 volts.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Start engine and allow it to reach operating temperature. Place gear selector in Park or Neutral, and apply parking brake. Increase engine speed to 1200 RPM. Using scan tool, read HO2S BANK 2, SENSOR 1 voltage. If voltage is greater than 0.976 volt, go to next step. If voltage is not greater than 0.976 volt, go to step 4).
3. Turn ignition off. Disconnect HO2S connector. Connect a jumper wire between HO2S harness connector signal and ground circuits, and chassis ground. Turn ignition on, engine off. If voltage is less than 0.2 volt, go to step 5). If voltage is not less than 0.2 volt, go to step 6).
4. DTC P0152 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.
5. Go to DIAGNOSTIC AIDS.

6. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
7. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0152. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
8. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for proper fuel pressure. Check for proper fuel injector operation. Check EVAP canister for fuel saturation. Check for leaking fuel pressure regulator diaphragm. Check for proper TP sensor operation. Check HO2S for silicone contamination (powdery white deposit). Using scan tool, check HO2S voltage. Voltage should be more than one volt. Check HO2S voltage with connector disconnected. If voltage goes from more than one volt to about 0.45 volt, replace HO2S. Never solder HO2S wires.

DTC P0153 - HO2S SLOW RESPONSE BANK 2, SENSOR 1

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions required to test for DTC are:

- No ECT, IAT, MAF, MAP or TP sensor DTCs set.
- No EVAP system DTC set.
- No other DTC tests in progress.
- No device controls active.
- HO2S average transition tome from lean-to-rich or rich-to -lean is greater than 100 milliseconds.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. If any other HO2S DTCs are set, diagnose affected DTCs. If no other HO2S DTCs are set, go to next step.
3. Using scan tool, read MAP sensor voltage, with engine idling. If voltage is greater than 4 volts, see **DTC**

P0108 . If voltage is not greater than 4 volts, go to next step.

4. Visually inspect exhaust system for leaks near HO2S. If leaks are found, go to step 8). If no leaks are found, go to next step.
5. Visually inspect HO2S for secure installation. If HO2S is not securely installed, go to step 8). If HO2S is securely installed, go to next step.
6. Ensure HO2S connector and harness are not contacting engine or exhaust system. If connector or harness are contacting engine or exhaust system, go to step 8). If connector and harness are okay, go to next step.
7. Check HO2S for silicone (powdery white) deposit, engine oil or coolant contamination. If contamination exists, go to step 9). If no contamination exists, see DIAGNOSTIC AIDS.
8. Repair as necessary. After repairs, go to step 11).
9. Repair source of contamination. After repairs, go to step 11).
10. Replace HO2S. After replacing sensor, go to next step.
11. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0153. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
12. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check HO2S Heater operation. Never solder HO2S wires.

DTC P0154 - HO2S INSUFFICIENT ACTIVITY BANK 2, SENSOR 1

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM reads and stores sensor voltage information and evaluates the voltage samples to determine amount of time sensor voltage is out of range. If HO2S voltage is out of predetermined range, DTC will set.

Conditions required to test for DTC are:

- No ECT, IAT, MAF, MAP or TP sensor DTCs set.
- No EGR and EVAP system DTC set.
- No other DTC tests in progress.
- No device controls active.
- Engine running at least 2 minutes.
- HO2S voltage is greater than 299 mV, but less than 598 mV.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Start and warm engine to normal operating temperature. Place gear selector in Park or Neutral, and apply parking brake. Increase engine speed to greater than 1200 RPM for 2 minutes. Using scan tool, read LOOP MODE. If scan tool displays CLOSED LOOP, go to step 5). If scan tool does not display CLOSED LOOP, go to next step.
3. Turn ignition off. Disconnect HO2S connector. Connect a jumper wire between HO2S harness connector signal and ground circuits, and chassis ground. Turn ignition on, engine off. If voltage is less than 0.2 volt, go to step 7). If voltage is not less than 0.2 volt, go to next step.
4. Remove jumper wire. Turn ignition off. Reconnect HO2S connector. Disconnect Blue VCM connector. Connect a test light between Blue VCM harness connector signal circuit and battery voltage. If test light illuminates, go to step 6). If test light does not illuminate, go to step 9).
5. DTC P0154 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, go to DIAGNOSTIC AIDS.
6. Check HO2S harness connector signal circuit for open. If open is found, go to step 11). If no open is found, go to step 8).
7. Check HO2S for faulty connection. If faulty connection is found, go to step 11). If connection is okay, go to step 10).
8. Check VCM for faulty connection. If faulty connection is found, go to step 11). If faulty connection is not found, go to step 12).
9. Repair open ground circuit. After repairs, go to step 13).
10. Replace HO2S. After replacing sensor, go to step 13).
11. Repair circuit as necessary. After repairs, go to step 13).
12. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0154. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
14. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Check for faulty HO2S heater. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P0155 - HO2S HEATER CIRCUIT BANK 2, SENSOR 1

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. When ignition is turned on, battery voltage is supplied to HO2S heater to provide for faster sensor warm-up, thus allowing sensor to become active in a shorter period of time. VCM reads amount of time necessary for sensor to become active after start-up.

Conditions required to set DTC are:

- MAF less than 27 grams per second.
- Engine running greater than 2 seconds.
- ECT and IAT less than 89.6°F (32°C).
- Difference between ECT and IAT not greater than 41°F (5°C).
- Elapsed time HO2S bias voltage is greater than predetermined value.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

NOTE: If engine has been operating, allow engine to cool for about one hour before proceeding with tests.

2. Turn ignition off. Turn ignition, engine off. Using scan tool, read HO2S voltage. If voltage gradually decreases 0.15 volt, go to step 5). If voltage does not decrease, go to next step.
3. Disconnect HO2S harness connector. Connect a test light between chassis ground and ignition feed circuit at HO2S. If test light illuminates, go to next step. If test light does not illuminate, go to step 6).
4. Connect test light between ignition feed and heater ground circuits at HO2S harness connector. If test light illuminates, go to step 7). If test light does not illuminate, go to step 8).
5. DTC P0155 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.
6. Check HO2S (bank 2 sensor 1) fuse. If fuse is open, go to step 14). If fuse is okay, go to step 9).
7. Check HO2S for faulty connection. If faulty connection is found, go to step 12). If connection is okay, go to step 15).
8. Check HO2S for faulty connection. If faulty connection is found, go to step 12). If connection is okay, go to step 10).
9. Check HO2S for faulty connection. If faulty connection is found, go to step 12). If connection is okay, go to step 11).
10. Repair open HO2S ground circuit. After repairs, go to step 16).
11. Check for open HO2S harness connector ignition feed circuit. After repairs, go to step 13).
12. Repair faulty connection. After repairs, go to step 16).

13. Repair open HO2S ignition feed circuit. After repairs, go to step 16).
14. Repair short to ground in HO2S ignition feed circuit. After repairs, go to step 16)
15. Replace HO2S. After replacing sensor, go to next step.
16. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0155. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
17. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Never solder HO2S wires.

DTC P0171 - FUEL TRIM SYSTEM LEAN BANK 1

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM reads HO2S signal voltage and adjusts fuel delivery based on this voltage. A change made to fuel delivery is indicated by Long Term (LT) and Short Term (ST) FUEL TRIM values.

ST FUEL TRIM values change rapidly in response to HO2S signal voltages. These changes fine tune engine fueling. LT FUEL TRIM values changes in response to trends in ST fuel trim. LT fuel trim makes coarse adjustments to fueling in order to re-center and restore control to ST fuel trim. LT and ST fuel trim can be read by using a scan tool.

Ideal FUEL TRIM value is about 128. Fuel trim value greater than 128 indicates that VCM is adding fuel to compensate for a lean condition. Fuel trim less than 128 indicates that VCM is reducing amount of fuel to compensate for rich condition. DTC will set if VCM detects an excessively rich or lean condition.

Conditions required to test for DTC are:

- No IAC DTCs set at idle
- No ECT, EGR, HO2S, IAT, MAF, MAP, TP or VSS sensor DTCs set.
- No EVAP or voltage system DTCs set.
- No misfire DTCs set.
- TP position less than 69.9 percent.
- Engine speed 575-4500 RPM.
- BARO greater than 70 kPa.
- ECT greater than 32°F (0°C) but less than 210°F (99°C).

- MAP greater than 20 kPa but less than 99 kPa.
- IAT greater than 29°F (-20°C) but less than 158°F (70°C).
- Airflow greater than 3 gm/s. but less than 150 gm/s.
- Vehicle speed less than 85 MPH.
- Average short term trim is not greater than 115.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Check exhaust system for corrosion, loose or missing hardware. Ensure HO2S is installed securely, and connector and harness are not contacting exhaust manifold or ignition wires. Check vacuum hoses for splits, kinks and proper routing. Check throttle body, intake manifold, and EGR valve for vacuum leaks. Check IAC, if high or unsteady idle condition exists. Check crankcase ventilation valve, spring and "O" ring for proper installation. Check for fuel contamination. Check for good VCM and sensor grounds. If any of these items isolate or require repair, go to step 8). If all items are okay, go to next step.
3. Cautiously connect a fuel pressure gauge to fuel rail. Turn ignition off for 10 seconds. Turn A/C off. Turn ignition on, engine off (fuel pump should run for about 2 seconds). Cycle ignition off and on until maximum pressure is obtained. Note fuel pressure while pump is running (pressure may vary slightly when pump stops). If pressure holds at 60-66 psi (4.2-4.6 kg/cm^2), go to next step. If pressure is not as specified, go to step 11).
4. Start and idle engine. If fuel pressure drops 3-10 psi (0.2-0.7 kg/cm^2), go to next step. If fuel pressure does not drop as specified, go to step 11).
5. Perform INJECTOR BALANCE TEST under FUEL SYSTEM in the SYSTEM/COMPONENT TESTS article. If an injector problem is found, go to step 9). If injectors are okay, go to next step.
6. Perform EVAP CANISTER PURGE SOLENOID CHECK. See FUEL EVAPORATION CONTROL, under EMISSION SYSTEMS & SUB-SYSTEMS in the **BASIC TESTING - 4.3L** article. If a solenoid problem is found, go to next step. If solenoid is okay, go to DIAGNOSTIC AIDS.
7. Repair EVAP system. Operate vehicle in closed loop mode while using scan tool to read LT and ST FUEL TRIM values. LT FUEL TRIM value should decrease to less than 158, ST FUEL TRIM value should decrease to less than 180. If FUEL TRIM values are as specified, go to step 10). If values are not as specified, see DIAGNOSTIC AIDS.
8. Repair items as necessary. Operate vehicle in closed loop mode while using scan tool to read LT and ST FUEL TRIM values. LT FUEL TRIM value should decrease to less than 158, ST FUEL TRIM value should decrease to less than 180. If FUEL TRIM values are as specified, go to step 10). If values are not as specified, go to step 3).
9. Replace fuel injector(s) as necessary. Operate vehicle in closed loop mode while using scan tool to read LT and ST FUEL TRIM values. LT FUEL TRIM value should decrease to less than 158, ST FUEL TRIM value should decrease to less than 180. If FUEL TRIM values are as specified, go to next step. If values are not as specified, go to step 6).
10. Lean condition does not exist. If driveability problem still exists, see the TESTS W/O CODES article.
11. See FUEL SYSTEM DIAGNOSIS under BASIC FUEL SYSTEM CHECKS in the **BASIC TESTING -**

4.3L article.

12. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0171. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
13. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

If problem cannot be isolated, attempt driving vehicle under various load conditions while using scan tool to read LT and ST FUEL TRIM values. This may help isolate condition which set DTC P0171. If condition to set DTC cannot be duplicated, problem could have been caused by a cylinder misfire. See **DTC P0300** .

DTC P0172 - FUEL TRIM SYSTEM RICH BANK 1

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM reads HO2S signal voltage and adjusts fuel delivery based on this voltage. A change made to fuel delivery is indicated by Long Term (LT) and Short Term (ST) FUEL TRIM values.

ST FUEL TRIM values change rapidly in response to HO2S signal voltages. These changes fine tune engine fueling. LT FUEL TRIM values change in response to trends in ST fuel trim. LT fuel trim makes coarse adjustments to fueling in order to re-center and restore control to ST fuel trim. LT and ST fuel trim can be read by using a scan tool.

Ideal FUEL TRIM value is about 128. Fuel trim value greater than 128 indicates that VCM is adding fuel to compensate for a lean condition. Fuel trim less than 128 indicates that VCM is reducing amount of fuel to compensate for rich condition. DTC will set if VCM detects an excessively rich or lean condition.

Conditions required to test for DTC are:

- No IAC DTCs set (at idle)
- No ECT, EGR, HO2S, IAT, MAF, MAP, TP or VSS sensor DTCs set.
- No EVAP or voltage system DTCs set.
- No misfire DTCs set.
- Engine speed 575-4500 RPM.
- TP angle less than 70 percent.
- Engine speed is greater than 575 RPM but less than 4500 RPM.
- BARO is greater than 70 kPa.
- MAP greater than 20 kPa, but less 99 kPa.

- IAT greater than -4°F (-20°C), but less than 158°F (70°C).
- MAF greater than 3 gm/s. but less than 150 gm/s.
- Vehicle speed less than 85 MPH.
- Average short term fuel trim is not greater than 115.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Check air intake duct for restrictions. Check for plugged air filter. Check IAC, if low or unsteady idle condition exists. Check throttle body for coking and IAC passages for blockage. Check fuel pressure regulator for proper operation. See FUEL SYSTEM DIAGNOSIS under BASIC FUEL SYSTEM CHECKS in the **BASIC TESTING - 4.3L** article. Check TP sensor for loose or missing mounting bolts. Using scan tool, read TP sensor voltage while slowly opening throttle from closed (0.20-0.74 volt) to wide open (4 volts). A steady throttle movement from a stop should cause TP sensor voltage to increase smoothly as throttle is opened. If any of these items isolate or require repair, go to step 7). If all items are okay, go to next step.
3. Connect a fuel pressure gauge to fuel rail. Turn ignition off for 10 seconds. Turn A/C off. Turn ignition on, engine off (fuel pump should run for about 2 seconds). Cycle ignition off and on until maximum pressure is obtained. Note fuel pressure while pump is running (pressure may vary slightly when pump stops). If pressure holds at 60-66 psi (4.2-4.6 kg/cm^2), go to next step. If pressure is not as specified, go to step 10).
4. Perform INJECTOR BALANCE TEST under FUEL SYSTEM in the SYSTEM/COMPONENT TESTS article. If an injector problem is found, go to step 8). If injectors are okay, go to next step.
5. Check HO2S for silicon contamination (powdery white) deposit. If contamination is evident, go to step 11). If contamination is not evident, go to next step.
6. Operate vehicle in closed loop mode while using scan tool to read LT and ST FUEL TRIM values. If LT FUEL TRIM value increases to greater than 100 and ST FUEL TRIM value increases to greater than 94, go to step 9). If values are not as specified, go to DIAGNOSTIC AIDS.
7. Repair items as necessary. Operate vehicle in closed loop mode while using scan tool to read LT and ST FUEL TRIM values. LT FUEL TRIM value should increase to greater than 100, ST FUEL TRIM value should increase to greater than 94. If FUEL TRIM values are as specified, go to step 11). If values are not as specified, go to step 3).
8. Replace fuel injector(s) as necessary. Operate vehicle in closed loop mode while using scan tool to read LT and ST FUEL in closed loop mode while using scan tool to read LT and ST FUEL TRIM values. If LT value increases to greater than 100 and ST fuel value increases to greater than 94, go to step 11). If values are not as specified, go to step 5).
9. Rich condition does not exist. If driveability problem still exists, see the TESTS W/O CODES article.
10. See FUEL SYSTEM DIAGNOSIS under BASIC FUEL SYSTEM CHECKS in the **BASIC TESTING - 4.3L** article.
11. Replace HO2S (bank 2 sensor 1). After replacing sensor, go to next step.
12. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating

temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0172. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

13. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

If problem cannot be isolated, attempt driving vehicle under various load conditions while using scan tool to read LT and ST FUEL TRIM values. This may help isolate condition which set DTC P0172. If condition to set DTC cannot be duplicated, problem could have been caused by a cylinder misfire. See **DTC P0300** .

DTC P0174 - FUEL TRIM SYSTEM LEAN BANK 2

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM reads HO2S signal voltage and adjusts fuel delivery based on this voltage. A change made to fuel delivery is indicated by Long Term (LT) and Short Term (ST) fuel trim values.

ST fuel trim values change rapidly in response to HO2S signal voltages. These changes fine tune engine fueling. LT fuel trim values changes in response to trends in ST fuel trim. LT fuel trim makes coarse adjustments to fueling in order to re-center and restore control to ST fuel trim. LT and ST fuel trim can be read by using a scan tool.

Ideal fuel trim value is about 128. Fuel trim value more than 128 indicates that VCM is adding fuel to compensate for a lean condition. Fuel trim less than 128 indicates that VCM is reducing amount of fuel to compensate for rich condition. DTC will set if VCM detects an excessively rich or lean condition.

Conditions required to test for DTC are:

- No IAC DTCs set at idle.
- No ECT, EGR, HO2S, IAT, MAF, MAP, TP or VSS sensor DTCs set.
- No EVAP or voltage system DTCs set.
- No misfire DTCs set.
- Engine speed 575-4500 RPM.
- BARO is greater than 70 kPa.
- ECT is greater than 140°F (60°C) but less than 210°F (99°C).
- MAP greater than 20 kPa, but less than 99 kPa.
- IAT greater than -4°F (-20°C), but less than 159°F (70°C).
- MAF us greater than 3 gm/s., but less than 150 gm/s.
- Vehicle speed less than 85 MPH.

- Average short term fuel trim is not greater than 115.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Check exhaust system for corrosion, loose or missing hardware. Ensure HO2S is installed securely, and connector and harness are not contacting exhaust manifold or ignition wires. Check vacuum hoses for splits, kinks and proper routing. Check throttle body, intake manifold, and EGR valve for vacuum leaks. Check IAC, if high or unsteady idle condition exists. Check crankcase ventilation valve, spring and "O" ring for proper installation. Check for fuel contamination. Check for good VCM and sensor grounds. If any of these items isolate or require repair, go to step 8). If all items are okay, go to next step.
3. Cautiously connect a fuel pressure gauge to fuel rail. Turn ignition off for 10 seconds. Turn A/C off. Turn ignition on, engine off (fuel pump should run for about 2 seconds). Cycle ignition off and on until maximum pressure is obtained. Note fuel pressure while pump is running (pressure may vary slightly when pump stops). If pressure holds at 60-66 psi (4.2-4.6 kg/cm^2), go to next step. If pressure is not as specified, go to step 11).
4. Start engine and allow it to idle. If pressure drops 3-10 psi (0.2-0.7 kg/cm^2), go to next step. If pressure does not drop as specified, go to step 11).
5. Perform INJECTOR BALANCE TEST under FUEL SYSTEM in the SYSTEM/COMPONENT TESTS article. If an injector problem is found, go to step 9). If injectors are okay, go to next step.
6. Perform CANISTER PURGE SOLENOID CHECK under EMISSION SYSTEMS & SUB-SYSTEMS in the SYSTEM/COMPONENT TESTS article. If a solenoid problem is found, go to next step. If solenoid is okay, go to DIAGNOSTIC AIDS.
7. Repair EVAP system. Operate vehicle in closed loop mode while using scan tool to read LT and ST fuel trim values. LT fuel trim value should decrease to less than 158, ST fuel trim value should decrease to less than 180. If fuel trim values are as specified, go to step 10). If values are not as specified, go to DIAGNOSTIC AIDS.
8. Repair items as necessary. Operate vehicle in closed loop mode while using scan tool to read LT and ST fuel trim values. LT fuel trim value should decrease to less than 158, ST fuel trim value should decrease to less than 180. If fuel trim values are as specified, go to step 10). If values are not as specified, go to step 3).
9. Replace fuel injector(s) as necessary. Operate vehicle in closed loop mode while using scan tool to read LT and ST fuel trim values. LT fuel trim value should decrease to less than 158, ST fuel trim value should decrease to less than 180. If fuel trim values are as specified, go to next step. If values are not as specified, go to step 6).
10. Lean condition does not exist. If driveability problem still exists, see the TESTS W/O CODES article.
11. See FUEL SYSTEM DIAGNOSIS under BASIC FUEL SYSTEM CHECKS in the **BASIC TESTING - 4.3L** article.
12. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0174. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

13. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

If problem cannot be isolated, attempt driving vehicle under various load conditions while using scan tool to read LT and ST fuel trim values. This may help isolate condition which set DTC P0174. If condition to set DTC cannot be duplicated, problem could have been caused by a cylinder misfire. See **DTC P0300** .

DTC P0175 - FUEL TRIM SYSTEM RICH BANK 2

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM reads HO2S signal voltage and adjusts fuel delivery based on this voltage. A change made to fuel delivery is indicated by Long Term (LT) and Short Term (ST) fuel trim values.

ST fuel trim values change rapidly in response to HO2S signal voltages. These changes fine tune engine fueling. LT fuel trim values changes in response to trends in ST fuel trim. LT fuel trim makes coarse adjustments to fueling in order to re-center and restore control to ST fuel trim. LT and ST fuel trim can be read by using a scan tool.

Ideal fuel trim value is about 128. Fuel trim value more than 128 indicates that VCM is adding fuel to compensate for a lean condition. Fuel trim less than 128 indicates that VCM is reducing amount of fuel to compensate for rich condition. DTC will set if VCM detects an excessively rich or lean condition.

Conditions required to test for DTC are:

- No IAC DTCs set at idle.
- No ECT, EGR, HO2S, IAT, MAF, MAP, TP or VSS sensor DTCs set.
- No EVAP or voltage system DTCs set.
- No misfire DTCs set.
- Engine speed 575-4500 RPM.
- ECT at normal operating temperature.
- Airflow 3-150 gm/s.
- Vehicle speed less than 85 MPH.
- BARO greater than 70 kPa.
- ECT greater than 140°F (60°C) but less than 212°F (100°C).
- MAP greater than 20 kPa but less than 99 kPa.
- IAT greater than -4°F (-20°C) but less than 158°F (70°C).
- MAF greater than 3 gm/s. but less than 150 gm/sec.

- Average short term fuel trim is not greater than 115.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Check air intake duct for restrictions. Check for plugged air filter. Check IAC, if low or unsteady idle condition exists. Check throttle body for coking and IAC passages for blockage. Check fuel pressure regulator for proper operation. See FUEL SYSTEM DIAGNOSIS under BASIC FUEL SYSTEM CHECKS in the **BASIC TESTING - 4.3L** article. Check TP sensor for loose or missing mounting bolts. Using scan tool, read TP sensor voltage while slowly opening throttle from closed (0.20-0.74 volt) to wide open (4 volts). A steady throttle movement from a stop should cause TP sensor voltage to increase smoothly as throttle is opened. If any of these items isolate or require repair, go to step 8). If all items are okay, go to next step.
3. Cautiously connect a fuel pressure gauge to fuel rail. Turn ignition off for 10 seconds. Turn A/C off. Turn ignition on, engine off (fuel pump should run for about 2 seconds). Cycle ignition off and on until maximum pressure is obtained. Note fuel pressure while pump is running (pressure may vary slightly when pump stops). If pressure holds at 60-66 psi (4.2-4.6 kg/cm^2), go to next step. If pressure is not as specified, go to step 11).
4. Perform INJECTOR BALANCE TEST under FUEL SYSTEM in the SYSTEM/COMPONENT TESTS article. If an injector problem is found, go to step 9). If injectors are okay, go to next step.
5. Check HO2S for silicone contamination (powdery white) deposit. If contamination is evident, go to step 12). If contamination is not evident, go to next step.
6. Perform CANISTER PURGE SOLENOID CHECK under EMISSION SYSTEMS & SUB-SYSTEMS in the SYSTEM/COMPONENT TESTS article. If a solenoid problem is found, go to next step. If solenoid is okay, go to DIAGNOSTIC AIDS.
7. Repair EVAP system. Operate vehicle in closed loop mode while using scan tool to read LT and ST fuel trim values. LT fuel trim value should increase to more than 100, ST fuel trim value should increase to more than 94. If fuel trim values are as specified, go to step 10). If values are not as specified, go to DIAGNOSTIC AIDS.
8. Repair items as necessary. Operate vehicle in closed loop mode while using scan tool to read LT and ST fuel trim values. LT fuel trim value should increase to more than 100, ST fuel trim value should increase to more than 94. If fuel trim values are as specified, go to step 10). If values are not as specified, go to step 3).
9. Replace fuel injector(s) as necessary. Operate vehicle in closed loop mode while using scan tool to read LT and ST fuel trim values. LT fuel trim value should increase to more than 100, ST fuel trim value should increase to more than 94. If fuel trim values are as specified, go to next step. If values are not as specified, go to step 5).
10. Rich condition does not exist. If driveability problem still exists, see the TESTS W/O CODES article.
11. See FUEL SYSTEM DIAGNOSIS under BASIC FUEL SYSTEM CHECKS in the **BASIC TESTING - 4.3L** article.
12. Replace HO2S (bank 2 sensor 1) and go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating

temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0175. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

14. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

If problem cannot be isolated, attempt driving vehicle under various load conditions while using scan tool to read LT and ST fuel trim values. This may help isolate condition which set DTC P0175. If condition to set DTC cannot be duplicated, problem could have been caused by a cylinder misfire. See **DTC P0300** .

DTC P0300 - ENGINE MISFIRE DETECTED

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Misfire is detected using Camshaft Position (CMP) and Crankshaft Position (CKP) sensors. When VCM senses CKP deceleration not associated with normal engine speed reduction, CMP is used to determine misfiring cylinder. VCM determines misfires on each cylinder and evaluates a random misfire and sets DTC.

Conditions required to test for DTC are:

- No IAC DTCs set.
- No CKP, MAF, TP or VSS sensor DTCs set.
- Rough road not detected.
- Engine speed 300-5600 RPM.
- ECT at normal operating temperature.
- System voltage 9-16 volts.
- Positive throttle position change is less than 2.9 percent for 100 msec.
- Negative throttle position change is less than 2.9 percent for 100 msec.
- A misfire is detected.

Diagnostic Procedures

1

Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2

Review FAILURE RECORDS data. If other DTCs are stored, diagnose affected DTCs. If no other DTCs are present, go to next step.

3

Start engine and allow it to idle. Using scan tool, read MAP sensor voltage. If voltage is greater than 4 volts, go to **DTC P0108** . If voltage is not greater than 4 volts, go to next step.

5

Turn ignition off, and then on. Duplicate conditions required to set DTC. Using scan tool, read DTC PRESENT THIS IGNITION CYCLE. If scan tool displays DTC P0300, PRESENT THIS IGN, go to next step. If scan tool does not display DTC P0300, PRESENT THIS IGN, go to step 10).

6

Install a spark tester on No. 1 spark plug wire. Disconnect fuel injector harness at intake manifold. Crank engine and check for spark at tester. Repeat procedure for each spark plug wire. If spark was okay on all wires, go to next step. If spark was not okay, go to step 11).

7

Remove and check spark plugs for wear, excessive air gap, cracks or fouling. If spark plugs are okay, go to next step. If spark plugs are not okay, go to step 12).

8

Perform INJECTOR CIRCUIT TEST under FUEL SYSTEM DIAGNOSIS in the **BASIC TESTING - 4.3L** article. If fuel system is okay, go to next step. If not, go to step 13).

9

Diagnose and repair mechanical engine problem.

10

DTC P0300 is intermittent. See DIAGNOSTIC AIDS.

11

See IGNITION SYSTEM in the **BASIC TESTING - 4.3L** article.

12

Replace spark plug(s). After replacing spark plugs, go to step 14).

13

Repair as necessary. After repairs, go to next step.

14

Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0300. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

15

Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

A misfire could be caused by excessive vibration from sources other than engine. Check following items for possible cause of misfire: tire/wheel out of balance/round, uneven brake rotor or drum surface, or a rough road condition. Check plug wires for proper installation and operation. Check fuel level, condition and quality. If problem is intermittent, see the TESTS W/O CODES article.

DTC P0301 - CYLINDER NO. 1 MISFIRE DETECTED

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Misfire is detected using Camshaft Position (CMP) and Crankshaft Position (CKP) sensors. When VCM senses CKP deceleration not associated with normal engine speed reduction, CMP is used to determine misfiring cylinder. VCM determines misfires on each cylinder and evaluates a random misfire and sets DTC.

Conditions for setting DTC are:

- No IAC DTCs set.
- No CKP, CMP, MAF, TP or VSS sensor DTCs set.
- ECT at least 19°F (-7°C).
- Fuel tank level is greater than 10 percent.
- Engine speed at least 600 RPM and less than 5600 RPM.
- System voltage at least 9 volts, but less than 14 volts.
- Positive throttle position change less than 4.9 percent for 100 msec.
- Negative throttle position change less than 2.9 percent for 100 msec.
- A misfire is detected.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. If any other DTCs are set, go to next step. If no other DTCs are set, go to step 4).
3. Diagnose affected DTC.
4. Start engine and allow it to idle. Using scan tool, read MAP sensor voltage. If voltage is greater than 4 volts, go to **DTC P0108** . If voltage is not greater than 4 volts, go to next step.
5. Turn ignition off, and then on. Duplicate conditions required to set DTC. Using scan tool, read DTC PRESENT THIS IGNITION CYCLE. If DTC P0301 sets, go to next step. If DTC does not set, go to step 10).
6. Install a spark tester on No. 1 spark plug wire. Disconnect fuel injector harness at intake manifold. Crank engine and check for spark at tester. Repeat procedure for each spark plug wire. If spark was okay on all wires, go to next step. If spark was not okay, go to step 11).
7. Remove and check spark plugs for wear, excessive air gap, cracks or fouling. If spark plugs are okay, go to next step. If spark plugs are not okay, go to step 12).
8. Perform INJECTOR CIRCUIT TEST under FUEL SYSTEM DIAGNOSIS in the **BASIC TESTING - 4.3L** article. If fuel system is okay, go to next step. If fuel system is not okay, go to step 13).
9. Diagnose and repair mechanical engine problem.
10. DTC P0301 is intermittent. Go to DIAGNOSTIC AIDS.
11. See IGNITION SYSTEM in the **BASIC TESTING - 4.3L** article.
12. Replace spark plug(s). After replacing spark plugs, go to step 14).
13. Repair as necessary. After repairs, go to next step.
14. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0301. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
15. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

A misfire could be caused by excessive vibration from sources other than engine. Check following items for possible cause of misfire: tire/wheel out of balance/round, uneven brake rotor or drum surface, or a rough road condition. Check plug wires for proper installation and operation. Check fuel level, condition and quality. If problem is intermittent, see the TESTS W/O CODES article.

DTC P0302 - CYLINDER NO. 2 MISFIRE DETECTED

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Misfire is detected using Camshaft Position (CMP) and Crankshaft Position (CKP) sensors. When VCM senses CKP deceleration not associated with normal engine speed reduction, CMP is used to determine misfiring cylinder. VCM determines misfires on each cylinder and evaluates a random misfire and set DTC.

Conditions for setting DTC are:

- No IAC DTCs set.
- No CKP, CMP, MAF, TP or VSS sensor DTCs set.
- ECT at least 19°F (-7°C).
- Fuel tank level is greater than 10 percent.
- Engine speed at least 600 RPM and less than 5600 RPM.
- System voltage at least 9 volts, but less than 14 volts.
- Positive throttle position change less than 4.9 percent for 100 msec.
- Negative throttle position change less than 2.9 percent for 100 msec.
- A misfire is detected.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. If any other DTCs are set, diagnose affected DTCs. If no other DTCs are set, go to step 4).
3. Start engine and allow it to idle. Using scan tool, read MAP sensor voltage. If voltage is more than 4 volts, go to **DTC P0108** . If voltage is 4 volts or less, go to next step.
4. Turn ignition off, and then on. Duplicate conditions required to set DTC. Using scan tool, read DTC PRESENT THIS IGNITION CYCLE. If DTC P0302 sets, go to next step. If DTC does not set, go to step 9).
5. Install a spark tester on No. 2 spark plug wire. Disconnect fuel injector harness at intake manifold. Crank engine and check for spark at tester. Repeat procedure for each spark plug wire. If spark was okay on all wires, go to next step. If spark was not okay, go to step 10).
6. Remove and check spark plugs for wear, excessive air gap, cracks or fouling. If spark plugs are okay, go to next step. If spark plugs are not okay, go to step 11).
7. Perform cylinder compression test. See the **BASIC TESTING - 4.3L** article. If problem is found, repair as necessary. After repairs, go to step 13). If compression is okay, go to next step.
8. Perform INJECTOR CIRCUIT TEST under FUEL SYSTEM DIAGNOSIS in the **BASIC TESTING - 4.3L** article. If fuel system is okay, go to next step. If fuel system is not okay, go to step 12).
9. Misfire is currently not active. See DIAGNOSTIC AIDS.
10. See IGNITION SYSTEM in the **BASIC TESTING - 4.3L** article.
11. Replace spark plug(s). After replacing spark plug, go to step 13).
12. Repair as necessary. After repairs, go to next step.

13. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0302. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
14. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

A misfire could be caused by excessive vibration from sources other than engine. Check following items for possible cause of misfire: tire/wheel out of balance/round, uneven brake rotor or drum surface, or a rough road condition. Check plug wires for proper installation and operation. Check fuel level, condition and quality. If problem is intermittent, see the TESTS W/O CODES article.

DTC P0303 - CYLINDER NO. 3 MISFIRE DETECTED

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Misfire is detected using Camshaft Position (CMP) and Crankshaft Position (CKP) sensors. When VCM senses CKP deceleration not associated with normal engine speed reduction, CMP is used to determine misfiring cylinder. VCM determines misfires on each cylinder and evaluates a random misfire and set DTC.

Conditions for setting DTC are:

- No CKP, CMP, IAC, MAF, TP or VSS sensor DTCs set.
- ECT at least 19°F (-7°C).
- Fuel tank level is greater than 10 percent.
- Engine speed at least 600 RPM and less than 5600 RPM.
- System voltage at least 9 volts, but less than 14 volts.
- Positive throttle position change less than 4.9 percent for 100 msec.
- Negative throttle position change less than 2.9 percent for 100 msec.
- A misfire is detected.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. If any other DTCs are set, diagnose affected DTCs. If no other DTCs are set, go to step 4).
3. Start engine and allow it to idle. Using scan tool, read MAP sensor voltage. If voltage is greater than 4 volts, go to **DTC P0108** . If voltage is not greater than 4 volts, go to next step.

4. Turn ignition off, and then on. Duplicate conditions required to set DTC. Using scan tool, read DTC PRESENT THIS IGNITION CYCLE. If DTC P0303 sets, go to next step. If DTC does not set, go to step 9).
5. Install a spark tester on No. 1 spark plug wire. Disconnect fuel injector harness at intake manifold. Crank engine and check for spark at tester. Repeat procedure for each spark plug wire. If spark was okay on all wires, go to next step. If spark was not okay, go to step 10).
6. Remove and check spark plugs for wear, excessive air gap, cracks or fouling. If spark plugs are okay, go to next step. If spark plugs are not okay, go to step 11).
7. Perform compression test. Repair as necessary. After repairs, go to step 13). If compression is okay, go to next step.
8. Diagnose fuel injector circuit. See the SYSTEM/COMPONENT TESTS article. If fuel system is okay, go to next step. If fuel system is not okay, go to step 12).
9. Misfire is currently not active. Ensure ignition wires are securely attached to spark plugs and distributor cap. Check for secondary ignition cross firing.
10. See IGNITION SYSTEM in the SYSTEM/COMPONENT TESTS article.
11. Replace spark plug(s). After replacing spark plus(s), go to step 13).
12. Repair as necessary. After repairs, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0303. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
14. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

DTC P0304 - CYLINDER NO. 4 MISFIRE DETECTED

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Misfire is detected using Camshaft Position (CMP) and Crankshaft Position (CKP) sensors. When VCM senses CKP deceleration not associated with normal engine speed reduction, CMP is used to determine misfiring cylinder. VCM determines misfires on each cylinder and evaluates a random misfire and set DTC.

Conditions for setting DTC are:

- No IAC DTCs set.
- No CKP, CMP, MAF, TP or VSS sensor DTCs set.
- ECT at least 19°F (-7°C).
- Fuel tank level is greater than 10 percent.
- Engine speed at least 600 RPM and less than 5600 RPM.
- System voltage at least 9 volts, but less than 14 volts.

- Positive throttle position change less than 4.9 percent for 100 msec.
- Negative throttle position change less than 2.9 percent for 100 msec.
- A misfire is detected.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. If any other DTCs are set, diagnose affected DTCs. If no other DTCs are set, go to step 4).
3. Start engine and allow it to idle. Using scan tool, read MAP sensor voltage. If voltage is greater than 4 volts, go to **DTC P0108** . If voltage is not greater than 4 volts, go to next step.
4. Turn ignition off, and then on. Duplicate conditions required to set DTC. Using scan tool, read DTC PRESENT THIS IGNITION CYCLE. If DTC P0304 sets, go to next step. If DTC does not set, go to step 9).
5. Install a spark tester on No. 4 spark plug wire. Disconnect fuel injector harness at intake manifold. Crank engine and check for spark at tester. Repeat procedure for each spark plug wire. If spark was okay on all wires, go to next step. If spark was not okay, go to step 10).
6. Remove and check spark plugs for wear, excessive air gap, cracks or fouling. If spark plugs are okay, go to next step. If spark plugs are not okay, go to step 11).
7. Perform cylinder compression test. See the **BASIC TESTING - 4.3L** article. If problem is found, repair as necessary. After repairs, go to step 13). If compression is okay, go to next step.
8. Perform INJECTOR CIRCUIT TEST under FUEL SYSTEM DIAGNOSIS in the **BASIC TESTING - 4.3L** article. If fuel system is okay, go to next step. If fuel system is not okay, go to step 12).
9. Misfire is currently not active. See DIAGNOSTIC AIDS.
10. See IGNITION SYSTEM in the **BASIC TESTING - 4.3L** article.
11. Replace spark plug(s). After replacing spark plug(s), go to step 13).
12. Repair as necessary. After repairs, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0304. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
14. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

A misfire could be caused by excessive vibration from sources other than engine. Check following items for possible cause of misfire: tire/wheel out of balance/round, uneven brake rotor or drum surface, or a rough road condition. Check plug wires for proper installation and operation. Check fuel level, condition and quality. If problem is intermittent, see the TESTS W/O CODES article.

DTC P0305 - CYLINDER NO. 5 MISFIRE DETECTED

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Misfire is detected using Camshaft Position (CMP) and Crankshaft Position (CKP) sensors. When VCM senses CKP deceleration not associated with normal engine speed reduction, CMP is used to determine misfiring cylinder. VCM determines misfires on each cylinder and evaluates a random misfire and set DTC.

Conditions for setting DTC are:

- No IAC DTCs set.
- No CKP, CMP, MAF, TP or VSS sensor DTCs set.
- ECT at least 19°F (-7°C).
- Fuel tank level is greater than 10 percent.
- Engine speed at least 600 RPM and less than 5600 RPM.
- System voltage at least 9 volts, but less than 14 volts.
- Positive throttle position change less than 4.9 percent for 100 msec.
- Negative throttle position change less than 2.9 percent for 100 msec.
- A misfire is detected.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. If any other DTCs are set, diagnose affected DTCs. If no other DTCs are set, go to step 4).
3. Start engine and allow it to idle. Using scan tool, read MAP sensor voltage. If voltage is greater than 4 volts, go to **DTC P0108** . If voltage is not greater than 4 volts, go to next step.
4. Turn ignition off, then on. Duplicate conditions required to set DTC. Using scan tool, read DTC PRESENT THIS IGNITION CYCLE. If DTC P0305 sets, go to next step. If DTC does not set, go to step 9).
5. Install a spark tester on No. 5 spark plug wire. Disconnect fuel injector harness at intake manifold. Crank engine and check for spark at tester. Repeat procedure for each spark plug wire. If spark was okay on all wires, go to next step. If spark was not okay, go to step 10).
6. Remove and check spark plugs for wear, excessive air gap, cracks or fouling. If spark plugs are okay, go to next step. If spark plugs are not okay, go to step 11).
7. Perform cylinder compression test. See the **BASIC TESTING - 4.3L** article. If problem is found, repair as necessary. After repairs, go to step 13). If compression is okay, go to next step.
8. Perform INJECTOR CIRCUIT TEST under FUEL SYSTEM DIAGNOSIS in the **BASIC TESTING - 4.3L** article. If fuel system is okay, go to next step. If fuel system is not okay, go to step 12).
9. Misfire is currently not active. See DIAGNOSTIC AIDS.
10. See IGNITION SYSTEM in the **BASIC TESTING - 4.3L** article.

11. Replace spark plug(s). After replacing spark plug(s), go to step 13).
12. Repair as necessary. After repairs, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0305. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
14. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

A misfire could be caused by excessive vibration from sources other than engine. Check following items for possible cause of misfire: tire/wheel out of balance/round, uneven brake rotor or drum surface, or a rough road condition. Check plug wires for proper installation and operation. Check fuel level, condition and quality. If problem is intermittent, see the TESTS W/O CODES article.

DTC P0306 - CYLINDER NO. 6 MISFIRE DETECTED

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Misfire is detected using Camshaft Position (CMP) and Crankshaft Position (CKP) sensors. When VCM senses CKP deceleration not associated with normal engine speed reduction, CMP is used to determine misfiring cylinder. VCM determines misfires on each cylinder and evaluates a random misfire and set DTC.

Conditions for setting DTC are:

- No IAC DTCs set.
- No CKP, CMP, MAF, TP or VSS sensor DTCs set.
- ECT at least 19°F (-7°C).
- Fuel tank level is greater than 10 percent.
- Engine speed at least 600 RPM and less than 5600 RPM.
- System voltage at least 9 volts, but less than 14 volts.
- Positive throttle position change less than 4.9 percent for 100 msec.
- Negative throttle position change less than 2.9 percent for 100 msec.
- A misfire is detected.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2. If any other DTCs are set, diagnose affected DTCs. If no other DTCs are set, go to step 4).
3. Start engine and allow it to idle. Using scan tool, read MAP sensor voltage. If voltage is greater than 4 volts, go to **DTC P0108** . If voltage is not greater than 4 volts, go to next step.
4. Turn ignition off, and then on. Duplicate conditions required to set DTC. Using scan tool, read DTC PRESENT THIS IGNITION CYCLE. If DTC P0306 sets, go to next step. If DTC does not set, go to step 9).
5. Install a spark tester on No. 6 spark plug wire. Disconnect fuel injector harness at intake manifold. Crank engine and check for spark at tester. Repeat procedure for each spark plug wire. If spark was okay on all wires, go to next step. If spark was not okay, go to step 10).
6. Remove and check spark plugs for wear, excessive air gap, cracks or fouling. If spark plugs are okay, go to next step. If spark plugs are not okay, go to step 11).
7. Perform cylinder compression test. See the **BASIC TESTING - 4.3L** article. If problem is found, repair as necessary. After repairs, go to step 13). If compression is okay, go to next step.
8. Perform INJECTOR CIRCUIT TEST under FUEL SYSTEM DIAGNOSIS in the **BASIC TESTING - 4.3L** article. If fuel system is okay, go to next step. If fuel system is not okay, go to step 12).
9. Misfire is currently not active. See DIAGNOSTIC AIDS.
10. See IGNITION SYSTEM in the **BASIC TESTING - 4.3L** article.
11. Replace spark plug(s). After replacing spark plugs, go to step 13).
12. Repair as necessary. After repairs, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0306. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
14. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

A misfire could be caused by excessive vibration from sources other than engine. Check following items for possible cause of misfire: tire/wheel out of balance/round, uneven brake rotor or drum surface, or a rough road condition. Check plug sires for proper installation and operation. Check fuel level, condition and quality. If problem is intermittent, see the TESTS W/O CODES article.

DTC P0327 - KNOCK SENSOR LOW VOLTAGE

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Knock Sensor (KS) is used to detect engine detonation (knock). If excessive knock is present, VCM will retard timing until knock goes away. When KS module in VCM determines that an abnormally high knock level exist, VCM will set DTC P0327.

Conditions for setting DTC are:

- Timing is retarded no more than zero degrees.
- System voltage is greater than 10 volts, but not greater than 17.1 volts.
- ECT greater than 140°F (60°C).
- Engine running at least 2 minutes.
- Engine speed is 500-900 RPM.
- Knock sensor noise less than 3 counts.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Operate vehicle within conditions required to set DTC. Using scan tool, select DTC, SPECIFIC function and enter DTC P0327. If scan tool displays DTC P0327 FAILED THIS IGN, go to step 4). If scan tool does not display DTC P0327 FAILED THIS IGN, go to next step.
3. Turn engine off. Turn ignition on, with engine off. Retrieve and record FAILED RECORDS data for DTC P0327. Operate vehicle within conditions required to set DTC. select DTC, SPECIFIC function and enter DTC P0327. If scan tool displays DTC P0327 FAILED THIS IGN, go to next step. If scan tool does not display DTC P0327 FAILED THIS IGN, see DIAGNOSTIC AIDS.
4. Disconnect knock sensor harness connector. Using a DVOM, check voltage between KS signal circuit and ground. Voltage reading should be about 5 volts. If voltage is not as specified, go to step 8). If voltage is as specified, go to next step.
5. Using DVOM, check resistance between knock sensor terminal and engine ground. Resistance should be about 100,000 ohms. If resistance is as specified, go to next step. If resistance is not as specified, go to step 12).
6. Turn ignition off. Connect DVOM between knock sensor terminal and engine ground. Tap on engine while observing DVOM. If any signal is present, go to next step. If signal is not present, go to step 9).
7. Check KS harness connector signal circuit for faulty terminal connection at KS. Repair as necessary and go to step 14). If terminal connections are okay, go to step 10).
8. Turn ignition off. Disconnect VCM harness connector. Turn ignition on and check KS signal circuit between VCM and KS harness connector for open, short to voltage or short to ground. Repair as necessary. After repairs, go to step 14). If circuit is okay, go to step 10).
9. Replace knock sensor. After replacing sensor, go to step 14).
10. Turn ignition off. Disconnect VCM harness connector. Check KS signal circuit for proper terminal connection at VCM. Repair or replace terminal as necessary. After repairs, go to step 14). If terminal is okay, go to next step.
11. Ensure KS module is fully seated and installed properly. If a problem is found, repair as necessary. After repairs, go to step 14). If no problem is found, go to next step.
12. Replace KS module. Operate vehicle within conditions required to set DTC. select DTC, SPECIFIC function and enter DTC P0327. If scan tool displays DTC P0327 FAILED THIS IGN, go to next step. If scan tool does not display DTC P0327 FAILED THIS IGN, go to step 14).

13. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
14. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0327. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
15. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connection at VCM. Check KS and VCM connectors for damage. Ensure KS harness is not routed too close to high-voltage wires, such as spark plug cables, ignition coils or other high-voltage components. Insure KS is installed properly and ensure torque is to specification. Torque specification is 14 ft. lbs. (19 N.m).

DTC P0336 - CRANKSHAFT POSITION SENSOR CIRCUIT PERFORMANCE

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Crankshaft Position (CKP) sensor sends reference signal to VCM to indicate position of crankshaft and engine speed (RPM). VCM uses this information to determine ignition coil, fuel injector and ignition timing.

Conditions required to set DTC are:

- Engine cranking and VCM receives 4 or more camshaft signals without receiving CKP signal.
- CKP signal is missing for at least .5 second.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. If vehicle starts and runs, see DIAGNOSTIC AIDS. If vehicle does not start and run, go to next step.
3. Disconnect CKP sensor harness connector. Using test light, probe ignition feed circuit of CKP sensor connector (engine side) to ground. Turn ignition on, engine off. If test light illuminates, go to next step. If test light does not illuminate, go to step 6).
4. Connect test light between ignition feed circuit and sensor low circuit of CKP sensor connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 7).
5. Turn ignition off. Install Gray jumpers from Connector Test Kit (J 35616-A) between engine harness connector and CKP sensor connector. Install DVOM set on duty cycle between CKP sensor 3X signal and low circuit terminals. Crank engine. If duty cycle is 40-60 percent, go to step 8). If duty cycle is not

40-60 percent, go to step 10).

6. Repair open or short to ground in CKP sensor ignition feed circuit. After repairs, go to step 13).
7. Check for open in sensor low circuit. If a problem was found, go to step 11). If a problem was not found, go to step 9).
8. With DVOM still connected between sensor 3X signal circuit and sensor low circuit, elect AC volt scale on DVOM. Crank engine. If voltage is greater than 10 volts, go to step 11). If voltage is not greater than 10 volts, go to next step.
9. Check for open in CKP sensor 3X signal and low circuits. If circuit is open, go to step 11). If circuit is okay, go to step 12).
10. Replace CKP sensor. Ensure CKP sensor mounting surface is clean and free of debris. After repairs, go to step 13).
11. Repair as necessary. After repairs, go to step 13).
12. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0336. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
14. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P0337 - CRANKSHAFT POSITION SENSOR CIRCUIT LOW FREQUENCY

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Crankshaft Position (CKP) sensor sends reference signal to VCM to indicate position of crankshaft and engine speed (RPM). VCM uses this information to determine ignition coil, fuel injector and ignition timing.

Conditions required for setting DTC are:

- Engine speed less than 4000 RPM.
- MAF at least 5 grams per second.
- Crank sensor duty cycle high reference to low reference ratio is less than .3125.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Disconnect CKP sensor harness connector. Connect a test light between engine ground and signal circuit at CKP sensor. Turn ignition on, engine off. If test light illuminates, go to next step. If test light does not illuminate, go to step 8).
3. Turn ignition off. Connect test light between battery voltage and ground circuit at CKP sensor. If test light illuminates, go to next step. If test light does not illuminate, go to step 7).
4. Disconnect VCM Blue connector. Connect test light between battery voltage and ignition feed circuit at CKP sensor. If test light illuminates, go to step 10). If test light does not illuminate, go to next step.
5. Reconnect VCM Blue connector. Install Gray jumpers from Connector Tester Kit (J35616-A) between CKP sensor and CKP sensor harness connector. Start engine. Connect a DVOM (set to duty cycle) between CKP sensor signal and ground circuits. If duty cycle is less than 40 percent, go to step 11). If duty cycle is not less than 40 percent, go to next step.
6. Check for faulty connection at CKP sensor and go to step 12).
7. Check for open in CKP sensor ground circuit. If open is found, go to step 12). If circuit is okay, go to step 9).
8. Check for open or short to ground in CKP sensor signal circuit and go to step 12).
9. Check for faulty connection at VCM. If faulty connection is found, go to step 12). If connection is okay, go to step 13).
10. Repair short to ground in CKP sensor signal circuit. After repairs, go to step 14).
11. Replace CKP sensor. After replacing sensor, go to step 14).
12. Repair circuit as necessary. After repairs, go to step 14).
13. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
14. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0337. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
15. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P0338 - CRANKSHAFT POSITION SENSOR CIRCUIT HIGH FREQUENCY

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Crankshaft Position (CKP) sensor sends reference signal to VCM to indicate position of crankshaft and engine speed (RPM). VCM uses this information to determine ignition coil, fuel injector and ignition timing.

Conditions foe setting DTC are:

- Engine speed less than 4000 RPM.
- MAF at least 5 grams per second.
- Crank sensor duty cycle high reference to low reference ratio is greater than .6875.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. If engine starts, go to step 4). If engine does not start, go to next step.
3. Using scan tool, clear DTCs. Crank engine for 10 seconds and read DTCs. If DTC P0338 resets, go to next step. If DTC does not reset, go to NO-START - ENGINE CRANKS OKAY in the **BASIC TESTING - 4.3L** article.
4. Start engine. Using scan tool, monitor engine speed (RPM). If RPM fluctuates up to twice desired RPM, go to step 14). If RPM does not fluctuate, go to next step.
5. Turn engine off. Turn ignition on, with engine off. Disconnect CKP sensor harness connector. Connect a test light between engine ground and signal circuit at CKP sensor. If test light illuminates, go to next step. If test light does not illuminate, go to step 8).
6. Connect test light between CKP sensor harness connector ground and signal circuits. If test light illuminates, go to next step. If test light does not illuminate, go to step 12).
7. Turn ignition off. Install Gray jumpers from Connector Tester Kit (J35616-A) between CKP sensor and CKP sensor harness connector. Using a DVOM, check voltage on CKP sensor harness connector signal circuit. If voltage is 2-3 volts, go to step 16). If voltage is not as specified, go to step 9).
8. Turn ignition off. Disconnect VCM Blue harness connector. Connect test light between battery voltage and ignition feed circuit at CKP sensor. If test light does not illuminate, go to step 15). If test light illuminates, go to step 11).
9. Check for open in CKP sensor ground circuit. If open is found, go to step 17). If circuit is okay, go to next step.
10. Check for short to ground in CKP sensor signal circuit. If short is found, go to step 17). If circuit is okay, go to step 13)
11. Repair short to ground in CKP sensor ignition feed circuit. After repairs, go to step 19).
12. Repair open CKP sensor ground circuit. After repairs, go to step 19).
13. Check for faulty connection at CKP sensor. If faulty connection is found, go to step 17). If connection is okay, go to next step.
14. Replace CKP sensor. After replacing sensor, go to step 19).
15. Check for open in CKP sensor harness connector ignition feed circuit. If open is found, go to step 17). If circuit is okay, go to next step.
16. Check for faulty connection at VCM. If faulty connection is found, go to next step. If connection is okay,

go to step 18).

17. Repair circuit as necessary. After repairs, go to step 19).
18. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
19. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0338. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
20. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P0339 - CRANKSHAFT POSITION SENSOR CIRCUIT INTERMITTENT

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Crankshaft Position (CKP) sensor sends reference signal to VCM to indicate position of crankshaft and engine speed (RPM). VCM uses this information to determine ignition coil, fuel injector and ignition timing.

Conditions for setting DTC:

- MAF at least 5 grams per second.
- Change in calculated engine speed is at least 1000 RPM.
- Calculated engine speed equals zero RPM and 4 or more CMP cycles have occurred for a period of 2-3 seconds.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. If engine starts and runs, see DIAGNOSTIC AIDS. If engine does not start and run, go to next step.
3. Disconnect CKP sensor harness connector. Connect a test light between engine ground and ignition feed circuit at CKP sensor. Turn ignition on, engine off. If test light illuminates, go to next step. If test light does not illuminate, go to step 6).
4. Connect test light between CKP sensor harness connector ground and ignition feed circuits. If test light illuminates, go to next step. If test light does not illuminate, go to step 7).

5. Turn ignition off. Install Gray jumpers from Connector Tester Kit (J 35616-A) between CKP sensor and CKP sensor harness connector. Connect a DVOM (set to duty cycle) between CKP sensor signal and ground circuits. Crank engine. If duty cycle is 40-60 percent, go to step 8). If duty cycle is not as specified, go to step 10).
6. Repair open or short to ground in CKP sensor ignition feed circuit. After repairs, go to step 13).
7. Check CKP sensor harness ground circuit for an open. If open is found, go to step 11). If no open is found, go to step 9).
8. Select DVOM AC volt scale. Crank engine. If voltage is greater than 10 volts, go to step 11). If voltage is not greater than 10 volts, go to next step.
9. Check CKP sensor harness connector signal and ground circuits for an open. If an open is found, go to step 11). If no open is found, go to step 12).
10. Ensure CKP sensor mounting surface is clean and free of debris. Replace CKP sensor. After replacing sensor, go to step 13).
11. Repair as necessary. After repairs, go to step 13).
12. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0339. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
14. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location. Inspect face of CKP sensor for metal shavings.

DTC P0340 - CAMSHAFT POSITION SENSOR CIRCUIT

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Camshaft Position (CMP) sensor is used to indicate camshaft position so that VCM can determine which cylinder is misfiring if misfire is present. CMP sensor also checks for properly installed high voltage switch.

Conditions required to set DTC:

- Engine running.
- CMP sensor reference pulse is not seen once every 6 revolutions.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Turn engine on and allow it to idle. Retrieve and record FREEZE FRAME and FAILED RECORDS data for DTC P0340. Continue to idle engine for one minute. Observe FREEZE FRAME, LAST TEST FAILED DTC. If DTC P0340 FAILED is not displayed, go to step 8). If DTC P0340 FAILED is displayed, turn engine off. Restart engine. If MIL remains on, go to next step. If MIL does not remain on, go to step 8).
3. Turn ignition on, with engine off. Disconnect CMP sensor harness connector. Connect a test light between engine ground and CKP sensor harness connector ignition feed circuit. If test light illuminates, go to next step. If test light does not illuminate, go to step 9).
4. Connect test light between CMP sensor harness connector ground and ignition feed circuits. If test light illuminates, go to next step. If test light does not illuminate, go to step 11).
5. Ignition off. Install Gray jumpers from Connector Test Kit (J35616-A) between CMP sensor and CMP sensor harness connector. Using a DVOM, check voltage between on CMP sensor signal circuit. If voltage is 5-7 volts, go to step 15). If voltage is not 5-7 volts, go to next step.
6. Check CMP sensor harness connector signal circuit for open. If open is found, go to step 13). If open is not found, go to next step.
7. Check CMP sensor harness connector signal circuit for short to voltage. If short is found, go to step 13). If short is not found, go to step 12).
8. DTC P0340 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.
9. Check for open in CMP sensor harness connector ignition feed circuit. If open is found, go to step 13). If open is not found, go to next step.
10. Repair short to ground in CMP sensor harness connector ignition feed circuit. After repairs, go to step 17).
11. Repair open in CMP sensor harness connector ground circuit. After repairs, go to step 17).
12. Check for faulty connection at CMP sensor. If faulty connection is found, go to next step. If connection is okay, go to step 14).
13. Repair circuit as necessary. After repairs, go to step 17).
14. Replace CMP sensor. After replacing sensor, go to step 17).
15. Check for faulty connection at VCM. If faulty connection is found, go to step 13). If connection is okay, go to next step.
16. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
17. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0340. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
18. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P0341 - CAMSHAFT POSITION SENSOR CIRCUIT

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

DTC P0341 will set if cam pulses are not in proper ratio to crank pulses.

Conditions for setting DTC:

- Engine running.
- Cam sensor reference pulse is not detected at correct interval.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Check for intermittent short to voltage or Electromagnetic Interference (EMI) on CMP sensor wires such as wires run alongside spark plug wires or high power transistors (like mobile radios operating nearby). If problem is found, go to next step. If no problem is found, go to step 4).
3. Repair short to voltage or correct EMI interference. After repairs, go to next step.
4. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0341. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
5. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P0401 - EGR SYSTEM INSUFFICIENT FLOW

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM test Exhaust Gas Recirculation (EGR) valve by momentarily commanding valve on while monitoring engine MAP. VCM will illuminate MIL and store DTC P0401 if expected increase is not seen under certain conditions during deceleration.

Conditions required to test for DTC are:

- No ECT, IAT, MAP, TP or VSS sensor DTCs set.
- No IAC, linear EGR (pintle position) or transmission DTCs set.
- Change in IAC less than 8 counts.
- ECT greater than 172°F (78°C).
- Vehicle speed greater than 27 MPH.
- BARO greater than 70 kPa.
- A/C clutch status unchanged.
- Transmission locked/unlocked status unchanged.
- No misfire DTC set.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Start and warm engine to normal operating temperature. Run engine at greater than 1500 RPM. Using scan tool, command EGR duty cycle through 25, 50, 75 and 100 percent positions. If engine runs rough as EGR is cycled, go to step 5). If engine does not run rough, go to next step.
3. Turn engine off. Turn ignition on, engine off. Disconnect EGR valve harness connector. Connect a test light between EGR valve harness connector ignition feed and control circuits. If test light does not illuminate, go to next step. If test light illuminates, go to step 7).
4. Start engine. Using scan tool, select MISCELLANEOUS TESTS, EGR CONTROL. With test light still connected, command EGR duty cycle increase to 100 percent. If test light illuminates as EGR is cycled, go to step 8). If test light does not illuminate, go to step 11).
5. Remove EGR valve and inspect valve and passages for damage. Inspect valve pintle to ensure it is not sticking partially open. If a problem is found, go to step 10). If no problem is found, go to next step.
6. See DIAGNOSTIC AIDS.
7. Check for short to ground in EGR valve control circuit. If short is found, go to step 14). If no short is found, go to step 15).
8. Check for restriction in EGR tube or passage. If restriction is found, go to step 10). If no restriction is found, go to next step.
9. Check for faulty electrical connection at EGR valve. If faulty connection is found, go to step 14). If connection is okay, go to next step.
10. Replace faulty EGR valve. After replacing EGR, go to step 16).
11. Check for an open in EGR control circuit. If an open is found, go to step 14). If an open is not found, go

to next step.

12. Check for an open in EGR ignition feed circuit. If an open is found, go to step 14). If an open is not found, go to next step.
13. Check for faulty connection at VCM. If faulty connection is found, go to next step. If connection is okay, go to step 15).
14. Repair circuit as necessary. After repairs, go to step 16).
15. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
16. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0401. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
17. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. Inspect VCM harness connector EGR control circuit for backed-out terminal. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

If EGR valve shows signs of excessive heat, check exhaust system for blockage or plugged catalytic converter. Ensure fuel injectors are functioning properly and check engine oil for fuel contamination.

DTC P0420 - TWC SYSTEM LOW EFFICIENCY BANK 1

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Three-Way Catalyst (TWC) system is used to control emission. VCM uses signal from Heated Oxygen Sensor (HO2S) behind TWC read efficiency of TWC. VCM will set DTC P0420 if TWC oxygen storage capacity is less than a predetermined threshold.

Conditions for setting DTC:

- System in "closed-loop".
- Commanded air/fuel ratio is 14.7:1.
- Converter warm-up test passed.
- No ECT, HO2S, IAT, MAF, MAP, TP or VSS sensor DTCs set.
- No fuel trim or misfire DTCs set.
- ECT greater than 167°F (75°C).
- Vehicle in closed loop operation.

- Listed conditions met for at least 2 consecutive minutes.
- Engine load steady.
- Vehicle speed steady at 20-70 MPH.
- IAT at least 14.5°F (-9.75°C).
- MAF less than 50 grams per second.
- Throttle above idle.
- HO2S BANK 1, SENSOR 3 average value plus or minus 0.008 volts than HO2S BANK 1, SENSOR 2 value.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Diagnose any other DTCs before proceeding. If no other DTCs are set, go to next step.
3. Check for and repair the following condition(s):
   - Ensure TWC is an O.E. part.
   - TWC for damage.
   - Ensure no internal damaged catalyst rattle exists.
   - Exhaust system for leaks, damage, loose or missing hardware.
   - Ensure HO2S bank 1 sensor 3 is securely installed, and harness and connector are not damaged or contacting exhaust.

   If any problem is found, go to step 9). If no problems are found, go to next step.
4. Check all VCM ground circuits. If problem is found, go to step 9). If no problem is found, go to next step.
5. Check all sensor ground circuits. If problem is found, to step 9). If no problem is found, go to next step.
6. Check HO2S bank 1 sensor 3 signal and ground circuits for intermittent opens. If problem is found, go to step 9). If no problem is found, go to next step.
7. Check HO2S bank 1 sensor 3 signal and ground circuits for intermittent short to ground. If problem is found, go to step 9). If no problem is found, go to next step.
8. Replace TWC. Check for possible engine misfire DTC or engine mechanical problem. After repairs, go to step 10.
9. Repair problem as necessary. After repairs, go to next step.
10. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0420. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
11. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Difficulty may be experienced in simulating conditions to set DTC, especially in urban areas.

DTC P0440 - EVAP SYSTEM

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Evaporative (EVAP) emission system includes following components: fuel tank, EVAP vent solenoid, fuel tank pressure sensor, fuel pipes and hoses, vapor lines, fuel cap, EVAP emission canister, purge lines, and EVAP purge solenoid.

Conditions required to set DTC are:

- No ECT, HO2S, IAT, MAP, TP or VSS sensor DTCs set.
- DTC P0125 not active.
- No fuel level related DTCs set.
- Fuel tank level greater than 12.5 and 87.5 percent.
- System voltage is greater than 10 volts but not less than 17 volts.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Turn ignition off. Remove fuel cap. Turn ignition on. Using scan tool, read FUEL TANK VACUUM. If scan tool displays zero in. H2O, go to next step. If scan tool does not display zero in. H2O, repair faulty fuel tank sensor circuit.
3. Zero pressure and vacuum gauges on EVAP Pressure/Purge Cart (J41413). Reinstall fuel cap. Read and Record FAIL RECORDS data for DTC P0440. Clear DTCs. Using scan tool, command EVAP vent solenoid ON (closed). Connect EVAP pressure/purge cart to EVAP service port. Using EVAP pressure/purge cart, attempt to pressurize EVAP system to 5 in. H2O. If specified pressure is achieved, go to next step. If specified pressure is not achieved, go to step 5).
4. Maintain EVAP system pressure at 5 in. H2O. Using scan tool, read FUEL TANK VACUUM. If scan tool displays 5 IN H2O, go to step 7). If scan tool does not display 5 IN H2O, go to step 6).
5. Disconnect fuel tank vapor and EVAP purge lines from EVAP canister. Plug fuel tank vapor line fitting at EVAP canister. Connect a hand-held vacuum pump to EVAP purge line fitting at EVAP canister. Ensure EVAP vent solenoid is still commanded ON (closed). Attempt to apply 5 in. Hg to EVAP canister. If vacuum is maintained as specified, go to step 10). If vacuum can not be maintained as specified, go to step 11).
6. Check EVAP purge line for restriction. If restriction is found, repair as necessary and go to step 15). If no restriction is found, repair faulty fuel tank sensor circuit.
7. Disconnect vacuum source line and plug vacuum source fitting at EVAP purge solenoid. Using scan tool,

command EVAP vent solenoid ON (closed) and EVAP purge solenoid ON (100%). Using EVAP pressure/purge cart, pressurize EVAP system to 5 in. H2O. Observe pressure gauge on EVAP pressure/purge cart while removing plug from vacuum source fitting line at EVAP purge solenoid. If fuel tank vacuum decreases to zero in. H2O within 15 seconds, go to step 10). If vacuum does not decrease as specified, go to step 12).

8. Connect EVAP pressure/purge cart vacuum gauge to vacuum source line. Start engine. Run engine speed to greater than 2000 RPM while observing vacuum gauge. If vacuum is greater than 15 in. Hg, see DIAGNOSTIC AIDS. If vacuum is 15 in. Hg or less, go to step 13).
9. Check if vent hose is disconnected or damaged. Check EVAP canister for damage. If a problem is found, repair as necessary. After repairs, go to step 15). If no problem is found, go to step 14).
10. Check for missing or faulty fuel filler cap. Check for disconnected, leaking or damaged fuel tank vapor line or EVAP purge line. If a problem is found, repair as necessary. After repairs, go to step 15). If no problem is found, go to next step.
11. Using scan tool, command EVAP vent solenoid ON (closed). With EVAP pressure/purge cart connected to EVAP service port, continuously attempt to pressurize EVAP system by leaving EVAP pressure/purge cart control knob in PRESSURIZE position. Using Ultrasonic Leak Detector (J41413), locate and repair EVAP system leak. It may be necessary to lower fuel tank to check connections at top of tank. Go to step 15).
12. Replace EVAP purge solenoid. After replacing purge solenoid, go to step 15).
13. Locate and repair cause of no source vacuum to EVAP purge solenoid. After repairs, go to step 15).
14. Replace EVAP vent solenoid. After replacing solenoid, go to next step.
15. Turn ignition on, engine off. Using scan tool, command EVAP vent solenoid ON (closed). Using EVAP pressure/purge cart pressurize EVAP system to 15 in. H2O. Monitor EVAP pressure/purge cart pressure gauge. Turn EVAP pressure/purge cart rotary switch to HOLD position. If pressure decreases to less than 10 in. H2O within 2 minutes, system is okay. If pressure does not decrease as specified, go to next step.
16. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0440. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
17. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check following items:

- For missing or damaged "O" rings at EVAP canister fuel vapor and purge line fittings.
- For cracks or punctures in EVAP canister.
- For damaged or disconnected source vacuum line, EVAP purge line, vent hose or fuel tank vapor line.
- For faulty connections at VCM. Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- For damaged harness. Inspect wiring harness to EVAP vent solenoid, EVAP purge solenoid, and fuel tank pressure sensor for intermittent open or short.

DTC P0442 - EVAP SYSTEM SMALL LEAK DETECTED

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Evaporative (EVAP) emission system includes following components: fuel tank, EVAP vent solenoid, fuel tank pressure sensor, fuel pipes and hoses, vapor lines, fuel cap, EVAP emission canister, purge lines, and EVAP purge solenoid.

Conditions required to set DTC are:

- No ECT, HO2S, IAT, MAP, ODM, or TP sensor DTCs set.
- DTC P0125 not active.
- No fuel level DTCs.
- Fuel level is greater than 12.5 and 87.5 percent.
- Vacuum decay for a period of at least 15 seconds.
- Vacuum less than 7 in. H2O for less than 25 seconds.
- Vacuum greater than .1 in. H2O for longer than 35 seconds.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Turn ignition off. Remove fuel cap. Turn ignition on. Using scan tool, read FUEL TANK VACUUM. If scan tool displays zero in. H2O go to next step. If scan tool does not display zero in. H2O, repair faulty fuel tank sensor circuit.
3. Zero pressure and vacuum gauges on EVAP Pressure/Purge Cart (J41413). Reinstall fuel cap. Read and Record FAIL RECORDS data for DTC P0442. Clear DTCs. Using scan tool, command EVAP vent solenoid on (closed). Connect EVAP pressure/purge cart to EVAP service port. Using EVAP pressure/purge cart, pressurize EVAP system to 5 in. H2O. Using scan tool, read FUEL TANK VACUUM. If scan tool displays -5 in. H2O, go to next step. If scan tool does not display -5 in. H2O, repair faulty fuel tank sensor circuit.
4. Turn ignition on, engine off. Using scan tool, command EVAP vent solenoid on (closed). Using EVAP pressure/purge cart pressurize EVAP system to 15 in. H2O. Monitor EVAP pressure/purge cart pressure gauge. Turn EVAP pressure/purge cart rotary switch to HOLD position. If pressure decreases to less than 10 in. H2O within 2 minutes, go to next step. If pressure does not decrease as specified, see DIAGNOSTIC AIDS.
5. Disconnect fuel tank vapor and EVAP purge lines from EVAP canister. Plug fuel tank vapor line fitting at EVAP canister. Connect a hand vacuum pump to EVAP purge line fitting at EVAP canister. Ensure EVAP vent solenoid is still commanded ON (closed). Attempt to apply 5 in. Hg to EVAP canister. If vacuum is maintained as specified, go to step 8). If vacuum cannot be maintained as specified, go to next

step.

6. Check if vent hose is disconnected or damaged. Check EVAP canister for damage. If a problem is found, repair as necessary. After repairs, go to step 10). If no problem is found, go to next step.
7. Replace EVAP vent solenoid. After replacing solenoid, go to step 10).
8. Check for missing or faulty fuel cap. Check for disconnected or leaking fuel tank vapor line. Check for disconnected or damaged EVAP purge line. If a problem is found, repair as necessary. After repairs, go to step 10. If no problem is found, go to next step.
9. Using scan tool, command EVAP vent solenoid on (closed). With EVAP pressure/purge cart connected to EVAP service port, attempt to pressurize EVAP system by leaving EVAP pressure/purge cart control knob in PRESSURIZE position. Using Ultrasonic Leak Detector (J41413), locate and repair EVAP system leak. It may be necessary to lower fuel tank to check connections at top of tank. After repairs, go to next step.
10. Turn ignition on, engine off. Using scan tool, command EVAP vent solenoid on (closed). Using EVAP pressure/purge cart pressurize EVAP system to 15 in. H2O. Monitor EVAP pressure/purge cart pressure gauge. Turn EVAP pressure/purge cart rotary switch to HOLD position. If pressure decreases to less than 10 in H2O within 2 minutes, return to step 2). If pressure does not decrease as specified, go to next step.
11. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0442. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
12. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check following items:

- For missing or damaged "O" rings at EVAP canister fuel vapor and purge line fittings.
- For cracks or punctures in EVAP canister.
- For damaged or disconnected source vacuum line, EVAP purge line, vacuum line, EVAP purge line, vent hose or fuel tank vapor line.
- For faulty connections at VCM. Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- For damaged harness. Inspect wiring harness to EVAP vent solenoid, EVAP purge solenoid, and fuel tank pressure sensor for intermittent open or short.

DTC P0446 - EVAP SYSTEM CANISTER VENT BLOCKED

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Evaporative (EVAP) emission system includes following components: fuel tank, EVAP vent solenoid, fuel tank

pressure sensor, fuel pipes and hoses, vapor lines, fuel cap, EVAP emission canister, purge lines, and EVAP purge solenoid.

Conditions for setting DTC are:

- No ECT, HO2S, IAT, MAP, ODM, or TP sensor DTCs set.
- DTC P0125 not active.
- No fuel level DTCs.
- Fuel tank level is greater than 12.5 and 87.5 percent.
- Excess vacuum present in EVAP system.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Turn ignition on. Read and Record FAIL RECORDS data for DTC P0446. Clear DTCs. Turn ignition off. Remove fuel cap. Turn ignition on. Using scan tool, read FUEL TANK VACUUM. If scan tool displays zero in. H2O go to next step. If scan tool does not display zero in. H2O, repair faulty fuel tank sensor circuit.
3. Zero pressure and vacuum gauges on EVAP Pressure/Purge Cart (J41413). Reinstall fuel cap. Using scan tool, command EVAP vent solenoid ON (closed). Connect EVAP pressure/purge cart to EVAP service port. Using EVAP pressure/purge cart, pressurize EVAP system to 5 in. H2O. Using scan tool, read FUEL TANK VACUUM. If scan tool displays 5 in. H2O, go to next step. If scan tool does not display 5 in. H2O, repair faulty fuel tank sensor circuit.
4. Maintain EVAP system pressure at 5 in. H2O. Using scan tool, command EVAP vent solenoid OFF (open). Monitor EVAP pressure/purge cart pressure gauge. If pressure decreases to zero in H2O within 5 seconds, see DIAGNOSTIC AIDS. If pressure does not decrease as specified, go to next step.
5. Disconnect vent hose, marked "AIR", from EVAP canister. Switch EVAP pressure/purge cart rotary switch to PURGE. Warm engine to normal operating temperature. Monitor vacuum gauge while holding engine speed at 2500 RPM. If vacuum remains at less than 30 in. H2O, go to next step. If vacuum is not as specified, go to step 9).
6. Check if vent hose is between EVAP canister and EVAP solenoid is kinked, pinched or blocked. If a problem is found, repair as necessary. After repairs, go to step 9). If no problem is found, go to next step.
7. Replace EVAP vent solenoid. After replacing solenoid, go to step 9).
8. Replace EVAP canister. After replacing canister, go to next step.
9. Using scan tool, command EVAP vent solenoid ON (closed). With EVAP pressure/purge cart connected to EVAP service port, to pressurize EVAP system to 5 in. H2O. Switch EVAP pressure/purge cart rotary switch to HOLD. Using scan tool, command EVAP vent solenoid OFF (open). If pressure decreases to zero in H2O within 5 seconds, system is okay. If pressure does not decrease as specified, return to step 2).

Diagnostic Aids

Check following items:

- For missing or damaged "O" rings at EVAP canister fuel vapor and purge line fittings.
- For faulty connections at VCM. Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- For damaged harness. Inspect wiring harness to EVAP vent solenoid, EVAP purge solenoid, and fuel tank pressure sensor for intermittent open or short.

DTC P0461 - FUEL LEVEL SENSOR CIRCUIT MALFUNCTION

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Fuel level sensor information is used by VCM to determine volume of fuel in fuel tank. Fuel level affects rate or change in air pressure in EVAP system.

Conditions required to set DTC are:

- Fuel tank level slosh test is completed
- Fuel tank main test is completed.
- Fuel tank level data valid.
- Fuel level signal has not changed for distance of 200 miles.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Turn ignition off. Turn ignition on, with engine off. Using scan tool, compare fuel level on scan tool and vehicle fuel gauge. If fuel level are about the same, go to next step. If not, go to step 5).
3. Record vehicle fuel gauge reading. Turn ignition off. Disconnect Black VCM harness connector. Turn ignition on. If fuel gauge reading changed, go to next step. If fuel gauge reading did not change, go to step 5).
4. Turn ignition off. Locate fuel level sending unit harness connector forward of fuel tank. Disconnect fuel sending unit harness connector. Using jumper wire, jumper fuel level input to fuel level sensor ground. Turn ignition on. Check fuel gauge and scan tool reading. If both reads Empty (zero percent), go to next step. If not, go to step 6).
5. Check and repair circuit to fuel gauge sending unit.
6. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
7. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0461. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

8. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

DTC P0462 - FUEL LEVEL SENSOR CIRCUIT LOW VOLTAGE

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Fuel level sensor information is used by VCM to determine volume of fuel in fuel tank. Fuel level affects rate or change in air pressure in EVAP system.

Conditions required to set DTC are:

- Fuel tank level slosh test is completed
- Fuel tank main test is completed.
- Fuel tank level data valid.
- Fuel level signal is less than .39 volt for a period greater than 20 seconds.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Turn ignition on, with engine off. Using scan tool, observe fuel level. If fuel level is 0-1 percent, go to step 4). If not, go to next step.
3. Diagnose vehicle's fuel level sender gauge module.
4. Using DVOM connected to ground, probe fuel level sensor input at fuel level sender gauge module. If voltage reading is less than .13 volt, go to next step. If voltage reading is not less than .13 volt, go to step 6).
5. Check for open in fuel level sensor input circuit. Repair as necessary. After repairs, go to step 9). If circuit is okay, go to next step.
6. Using DVOM connected to ground, probe fuel level output at fuel level sender gauge module. If voltage reading is less than .13 volt, go to next step. If voltage reading is not less than .13 volt, go to step 8).
7. Check for open in fuel level output circuit. Repair as necessary. After repairs, go to step 10). If circuit is okay, go to next step.
8. Using DVOM connected to ground, probe fuel level module output at fuel level sender gauge module. If voltage reading is greater than 2.9 volts, go to step 11). If voltage reading is not greater than 2.9 volts, go to step 12).
9. Repair open in fuel level sensor input circuit. After repairs, go to step 13).
10. Repair open in fuel level output circuit. After repairs, go to step 13).
11. Repair short to voltage in fuel level module output circuit. After repairs, go to step 13).

12. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0462. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
14. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

DTC P0463 - FUEL LEVEL SENSOR CIRCUIT HIGH VOLTAGE

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Fuel level sensor is an important input to VCM for enhanced evaporative system diagnostic. Fuel level is necessary for VCM to know volume of fuel in fuel tank. Fuel level affects rate of change in air pressure in EVAP system. Several enhanced evaporative system diagnostic sub-tests are dependent upon correct fuel level information. Diagnostic will not run when tank is greater than 85 percent or less than 15 percent full. Sensor signal will disable misfire when fuel levels are less than 15 percent.

Conditions for setting DTC:

- Fuel tank level slosh test is completed.
- Fuel tank level main test is completed.
- Fuel tank level data valid.
- Fuel level signal voltage is greater than 2.9 volts for a period longer than 20 seconds.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Turn ignition on, with engine off. Using scan tool, observe fuel level. If fuel level is 99-100 percent, go to step 4). If not, go to next step.
3. Diagnose vehicle's fuel level sender gauge module.
4. Using DVOM connected to ground, probe fuel level sensor input at fuel level sender gauge module. If voltage reading is greater than 2.9 volts, go to next step. If voltage reading is not greater than 2.9 volts, go to step 6).
5. Check for short to voltage in fuel level sensor input circuit. Repair as necessary. After repairs, go to step 9). If circuit is okay, go to next step.
6. Using DVOM connected to ground, probe fuel level output (terminal "D") at fuel level buffer module. If voltage reading is greater than 2.9 volts, go to next step. If voltage reading is not greater than 2.9 volts, go

to step 8).

7. Check for short to voltage in fuel level output circuit. Repair as necessary. After repairs, go to step 10). If circuit is okay, go to next step.
8. Check for open in fuel level buffer module sensor ground. Repair as necessary. After repairs, go to step 11). If circuit is okay, go to step 12).
9. Repair short to voltage in fuel level input circuit. After repairs, go to step 13).
10. Repair short to voltage in fuel level output circuit. After repairs, go to step 13).
11. Repair open in fuel level buffer module sensor ground. After repairs, go to step 13).
12. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0462. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
14. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

DTC P0500 - VEHICLE SPEED SENSOR CIRCUIT

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Vehicle Speed Sensor (VSS) is a magnetic induction type. Gear teeth pressed on outside of output shaft induce an AC current in sensor as shaft rotates. Signal goes directly to VCM. VCM uses pulsed signal to calculate vehicle speed based on time between pulses.

Conditions required for setting DTC:

- No MAP DTCs set.
- Throttle angle less than 3.125 percent.
- ECT greater than 140°F (60°C).
- Engine speed 1400-4400 RPM.
- MAP less than 20 kPa.
- All conditions met for 5 seconds.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Using scan tool, clear DTCs. Using Connector Test Adapter Kit (J35616) and a DVOM set to AC 200

volt scale, backprobe across VSS harness connector signal and ground circuits. Raise and support vehicle. Start engine and place transmission in gear. If voltage is constant, go to step 5). If voltage is not constant, go to next step.

3. If voltage varies, see DIAGNOSTIC AIDS. If voltage does not vary, go to next step.
4. If scan tool displays NO VOLTAGE, go to step 11). If scan tool does not display NO VOLTAGE, go to step12).
5. With vehicle still raised, disconnect VSS connector. With engine running, place transmission in gear. Using a DVOM on 200-volt AC scale, check voltage across signal and ground circuits at VSS. If voltage varies with RPM, go to step 7). If voltage does not vary, go to next step.
6. Replace VSS. After replacing sensor, go to step 12).
7. Check for faulty connection at VCM and VSS. If faulty connection is found, go to step 9). If connections are okay, go to next step.
8. Check for open or short in ground and signal circuits between VCM and VSS. If problem is found, go to step 10). If no problem is found, go to step 12).
9. Repair connection as necessary. After repairs, go to step 12).
10. Repair open or short as necessary. After repairs, go to step 12).
11. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
12. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0500. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
13. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Ensure VCM is properly calibrated for vehicle speedometer.

DTC P0506 - IDLE SPEED LOW IDLE AIR CONTROL RESPONDING

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM controls idle speed with an Idle Air Control (IAC) valve to a calculated RPM based on sensor inputs and actual engine RPM. VCM moves IAC valve in or out to vary amount of airflow into intake manifold and thus decrease or increase idle RPM.

VCM commands IAC in counts. A higher count, allows more air to by-pass throttle plate (higher idle).

Conditions required to test for DTC are:

- No ECT, MAP, TP or VSS sensor DTCs set.
- ECT greater than 122°F (50°C).
- IAT greater than -13°F (-25°C).
- BARO greater than 10.2 psi (0.72 kg/cm^2) at less than 10,300 ft.
- Vehicle speed less than 2 MPH.
- Throttle angle at less than 1%.
- Engine running greater than 30 seconds.
- Conditions met for greater than 3 seconds.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Using scan tool, read DTCs. If any other DTCs are set, diagnose affected DTCs. If no other DTCs are set, go to next step.
3. If DTC P0506 is active this ignition cycle, go to step 5). If DTC is not active this ignition cycle, go to next step.
4. DTC P0506 is intermittent. See DIAGNOSTIC AIDS.
5. Repair engine mechanical problem as necessary and go to next step.
6. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0506. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
7. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Ensure throttle stop screw has not been tampered with. Check for stuck IAC valve or throttle linkage. Reset IAC using scan tool MISC FUNCTIONS. Check if fuel system is running too rich or too lean. Inspect throttle body bore for foreign material.

DTC P0507 - IDLE SPEED HIGH IDLE AIR CONTROL RESPONDING

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM controls idle speed with an Idle Air Control (IAC) valve to a calculated RPM based on sensor inputs and actual engine RPM. VCM moves IAC valve in or out to vary amount of airflow into intake manifold and thus decrease or increase idle RPM.

VCM commands IAC in counts. A higher count, allows more air to by-pass throttle plate (higher idle).

Conditions required to test for DTC are:

- No ECT, MAP, TP or VS sensor DTCs set.
- ECT greater than 122°F (50°C).
- IAT greater than -13°F (-25°C).
- BARO greater than 70 kPa.
- Vehicle speed less than 2 MPH.
- System voltage greater than 10 volts, but less than 16 volts.
- Throttle at idle.
- Engine running longer than 30 seconds.
- Conditions met for more than 3 seconds.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Using scan tool, read DTCs. If any other DTCs are set, diagnose affected DTCs. If no other DTCs are set, go to next step.
3. If DTC P0507 is active this ignition cycle, go to step 6). If DTC is not active this ignition cycle, go to next step.
4. DTC P0507 is intermittent. See DIAGNOSTIC AIDS.
5. Repair engine mechanical problem as necessary. After repairs, go to next step.
6. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0507. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
7. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Ensure throttle stop screw has not been tampered with. Check for stuck IAC valve or throttle linkage. Reset IAC using scan tool MISC FUNCTIONS. Check if fuel system is running too rich or too lean. Inspect throttle body bore for foreign material.

DTC P0704 - CLUTCH SWITCH CIRCUIT (WITH MANUAL TRANSMISSION)

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

DTC determines if transmission clutch switch has failed by looking for a clutch switch transition within a range from zero MPH to some higher speed.

DTC will set when the following conditions are present:

- No VSS DTCs are set.
- Vehicle speed is greater than 40 MPH.
- No clutch transition is detected.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. After performing OBD system check, go to next step.
2. Turn ignition off. Install scan tool. Turn ignition on, with engine off. Using scan tool, display clutch switch parameter. Engage and disengage clutch several times. If scan tool display change indicates when clutch is engaged and disengaged, go to step 7). If scan tool display change does not indicate when clutch is engaged and disengaged, go to next step.
3. Check if brake fuse is blown, go to step 8). If fuse is not blown, go to next step.
4. Turn ignition off. Disconnect clutch switch connector. Connect a jumper wire between ignition feed circuit and signal circuit of clutch switch connector. Turn ignition on, with engine off. Using scan tool, check if clutch switch is on. If scan tool indicates clutch switch is on, go to next step. If scan tool indicates clutch switch is off, go to step 6).
5. Remove jumper wire from clutch switch connector. Using scan tool, check if clutch switch is off. If scan tool indicates clutch switch is off, go to step 11). If scan tool indicates clutch switch is on, go to step 9).
6. Check for open in signal circuit. If a problem was found, go to step 12). If a problem was not found, go to step 10).
7. DTC is intermittent. See the TESTS W/O CODES article.
8. Check and repair conditions that caused fuse to blow. Replace fuse. After replacing fuse, go to step 14).
9. Check for short to battery in signal circuit. If a problem was found, go to step 12). If a problem was not found, go to step 13).
10. Check for poor connections at VCM. If a problem was found, go to step 12). If a problem was not found, go to step 13).
11. Replace clutch switch. After replacing switch, go to step 14).
12. Repair as necessary. After repairs, go to step 14).
13. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
14. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0704. Operate vehicle within the conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, repeat step 2).
15. Using scan tool, select CAPTURE INFO, REVIEW INFO. If any undiagnosed DTC(s) are displayed, go

to applicable DTC test.

DTC P1106 - MAP SENSOR CIRCUIT INTERMITTENT HIGH VOLTAGE

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Manifold Absolute Pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). A 5-volt reference is applied to sensor. A variable resistor moves in relation to manifold pressure and a voltage signal is returned to VCM through MAP signal circuit. Voltage signal varies from 1.0-1.5 volts at closed throttle to 4.0-4.5 volts at wide open throttle (low vacuum). VCM utilizes MAP signal and throttle position to determine fuel delivery.

DTC will set when the following conditions are present:

- No TP sensor DTCs are set.
- Throttle position is not greater than 96.8 percent when engine speed is not greater than 1000 RPM.
- Throttle position is not greater than 89.8 percent when engine speed is greater than 1000 RPM.
- MAP greater than 4.9 volts.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. After performing OBD system check, go to next step.
2. If engine idle is unstable, incorrect, or if manifold vacuum at idle is less than 15 in. Hg, repair as necessary. Install scan tool. With engine idling, monitor MAP sensor voltage using scan tool. If MAP sensor voltage is greater than 4 volts, go to next step. If MAP sensor voltage is not greater than 4 volts, go to step 4).
3. Turn ignition off. Disconnect MAP sensor connector. Turn ignition on. Monitor MAP sensor voltage using scan tool. If MAP sensor voltage is less than one volt, go to step 5). If MAP sensor voltage is not less than one volt, go to step 9).
4. DTC is intermittent. If no additional DTCs are set, see DIAGNOSTIC AIDS. If any additional DTCs are set, go to applicable DTC test.
5. With DVOM to ground, probe 5-volt reference circuit at MAP sensor connector. If voltage is greater than 5.2 volts, go to step 10). If not, go to next step.
6. Using test light, probe MAP sensor connector ground circuit to battery voltage. If test light illuminates, go to step 7). If test light does not illuminate, go to step 14).
7. Check for restriction in MAP sensor vacuum source. If a problem was found, go to step 15). If a problem was not found, go to next step.
8. Replace MAP sensor. After replacing sensor, go to step 19).
9. Check for short to voltage in MAP signal circuit. If a problem was found, go to step 15). If a problem was not found, go to step 18).

10. Ignition off. Unplug VCM White connector. Ignition on. With DVOM to ground, check voltage on VCM connector MAP sensor 5-volt reference circuit terminal. If voltage is greater than 5.2 volts, go to next step. If not, go to step 13).
11. Unplug EGR electrical connector. Check voltage on VCM connector EGR sensor 5-volt reference circuit terminal. If voltage is greater than 5.2 volts, go to next step. If not, go to step 16).
12. Repair short to voltage on 5-volt reference circuit. After repairs, go to step 19).
13. With DVOM to ground, measure voltage on VCM connector TP sensor 5-volt reference circuit terminal. If voltage is greater than 5.2 volts, go to step 17). If not, go to step 18).
14. Repair MAP ground circuit. After repairs, go to step 19).
15. Repair as necessary. After repairs, go to step 19).
16. Replace EGR valve. After replacing EGR valve, go to step 19).
17. Repair short to voltage on the 5-volt reference circuit. After repairs, go to step 19).
18. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
19. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P1106. Operate vehicle within the conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, repeat step 2).
20. Using scan tool, select CAPTURE INFO, REVIEW INFO. If any undiagnosed DTC(s) are displayed, go to applicable DTC test.

Diagnostic Aids

An intermittent ground in MAP signal circuit or 5-volt reference circuit will result in DTC P1106 setting. With ignition on and engine off, manifold pressure is equal to atmospheric pressure with signal voltage high. VCM uses information as an indication of vehicle altitude.

To test accuracy of a suspect sensor, compare reading with a known-good vehicle. Reading should be 3.6-4.9 volts. If DTC is intermittent, see the TESTS W/O CODES article. To check for intermittent connection, disconnect sensor from bracket and twist sensor by hand. Output changes greater than .1 volt indicates a poor connection or connector. If okay, replace sensor. Ensure electrical connection remains securely connected. If sensor is removed from intake manifold, sensor-to-manifold seal must be replaced.

DTC P1107 - MAP SENSOR CIRCUIT INTERMITTENT LOW VOLTAGE

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Manifold Absolute Pressure (MAP) sensor measures changes in intake manifold pressure (vacuum). A low voltage signal, 1.0-1.5 volts, is sent to VCM on 5-volt reference circuit at closed throttle (high vacuum). A high voltage signal, 4.0-4.5 volts is sent at wide open throttle (low vacuum).

Conditions required to set DTC are:

- Engine speed is 800 RPM or less with throttle closed, or more than 800 RPM with throttle slightly above idle.
- MAP sensor voltage less than 0.2 volt.
- No TP sensor DTCs are set.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Turn engine on and allow it to idle. Using scan tool, read MAP sensor voltage. If voltage is less than 0.5 volt, go to next step. If voltage is not less than 0.5 volt, go to step 5).
3. Turn ignition off. Disconnect MAP sensor harness connector. Connect a jumper wire between MAP sensor harness connector 5-volt reference and signal circuits. Turn ignition on. If voltage is greater than 4.7 volts, go to step 6). If voltage is not greater than 4.7 volts, go to next step.
4. Turn ignition off. Disconnect jumper wire. Connect a test light between battery voltage and MAP sensor harness connector signal circuit. Turn ignition on. If voltage is greater than 4.7 volts, go to step 9). If voltage is not greater than 4.7 volts, go to step 7).
5. DTC P1107 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, go to DIAGNOSTIC AIDS.
6. Check for faulty connection at MAP sensor. If faulty connection is found, go to step 12). If connection is okay, go to step 11).
7. Check for open MAP sensor signal circuit. If circuit is open, go to step 12). If circuit is okay, go to next step.
8. Check MAP sensor signal circuit for short to ground. If short is found, go to step 12). If circuit is okay, go to step 13).
9. Check for open in MAP sensor 5-volt reference circuit. If open is found, go to step 12). If circuit is okay, go to next step.
10. Check MAP sensor 5-volt reference circuit for short to ground. If short is found, go to step 12). If circuit is okay, go to step 13).
11. Replace faulty MAP sensor. After replacing sensor, go to step 14).
12. Repair circuit as necessary. After repairs, go to step 14).
13. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
14. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1107. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
15. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check MAP sensor signal and 5-volt reference circuits for intermittent open condition.

With ignition on and engine off, MAP signal is equal to atmospheric pressure with signal voltage high. This information is used by VCM as an indication of altitude. Comparison of this reading with a known-good vehicle with same sensor is a way to check accuracy of suspect sensor. Reading should be within 0.4 volt.

Disconnect sensor from bracket and twist sensor by hand to check for intermittents. Output changes greater than 0.1 volt indicate a faulty sensor connection.

DTC P1111 - IAT SENSOR CIRCUIT INTERMITTENT HIGH VOLTAGE

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Intake Air Temperature (IAT) sensor is a thermistor. VCM applies and reads a 5-volt reference signal to sensor. When air is cold, sensor resistance is high and VCM will measure a high signal voltage. If air is warm, sensor resistance is low causing VCM to measure low voltage.

Conditions required to set DTC are:

- No ECT, VSS, MAF sensor DTCs not set.
- Vehicle speed less than 2 MPH.
- ECT greater than 183.2°F (84°C).
- IAT greater than -34.6°F (-37°C).
- Engine run time greater than 100 seconds.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Turn engine on and allow it to idle. Using scan tool, read IAT sensor voltage. If voltage is greater than 4.9 volts, go to next step. If voltage is not greater than 4.9 volts, go to step 6).
3. Turn ignition off. Disconnect IAT sensor harness connector. Connect a jumper wire between IAT sensor harness connector 5-volt reference and ground circuits. Turn ignition on. If voltage is less than 0.82 volt, go to step 7). If voltage is not less than 0.82 volt, go to next step.
4. Connect jumper wire between IAT sensor harness connector signal circuit and engine ground. If voltage is less than 0.82 volt, go to step 8). If voltage is 0.82 volt or greater, go to next step.
5. If DTC P0123 is also set, go to **DTC P0123** for diagnosis. If DTC is not set, go to step 9).
6. DTC P1111 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.

7. Check for faulty connection at IAT sensor and at VCM. If faulty connection is found, go to step 10). If connections are okay, go to step 11).
8. Check for open IAT sensor ground circuit. If open is found, go to step 10). If circuit is okay, go to step 12).
9. Check for open IAT sensor signal circuit. If open is found, go to next step. If circuit is okay, go to step 12).
10. Repair circuit as necessary. After repairs, go to step 13).
11. Replace IAT sensor. After replacing sensor, go to step 13).
12. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1111. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
14. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections at IAT sensor and at VCM. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location. Check for skewed IAT sensor. See **IAT TEMPERATURE-TO-RESISTANCE VALUES** table.

DTC P1112 - IAT SENSOR CIRCUIT INTERMITTENT LOW VOLTAGE

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Intake Air Temperature (IAT) sensor is a thermistor. VCM applies and reads a 5-volt reference signal to sensor. When air is cold, sensor resistance is high and VCM will measure a high signal voltage. If air is warm, sensor resistance is low causing VCM to measure low voltage.

Conditions required to set DTC are:

- No VSS DTCs set.
- Vehicle speed at least 2 MPH.
- Engine running longer than 100 seconds.
- IAT sensor voltage less than 0.82 volt.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L**

article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.

2. Turn engine on and allow it to idle. Using scan tool, read IAT sensor voltage. If voltage is less than 0.82 volt, go to next step. If voltage is not less than 0.82 volt, go to step 5).
3. Turn engine off. Turn ignition on. Disconnect IAT sensor harness connector. If voltage is greater than 4 volts, go to step 7). If voltage is not greater than 4 volts, go to next step.
4. Turn ignition off. Using DVOM, check resistance across IAT sensor harness connector. If resistance is infinite, go to step 8). If resistance is not infinite, go to step 6).
5. DTC P1112 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.
6. Repair short to ground in IAT sensor signal circuit. After repairs, go to step 9).
7. Replace IAT sensor. After replacing sensor, go to step 9).
8. Replace VCM. Replacement VCM requires special equipment for programming procedures. After replacing VCM, go to next step.
9. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1112. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
10. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections at IAT sensor and at VCM. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location. Check for skewed IAT sensor. See IAT TEMPERATURE-TO-RESISTANCE VALUES.

DTC P1114 - ECT SENSOR CIRCUIT INTERMITTENT LOW VOLTAGE

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Engine Coolant Temperature (ECT) sensor is a thermistor that varies resistance based on temperature. As temperature of sensor increases, resistance decreases. High temperature will result in a low signal voltage. DTC will set when VCM sees an ECT sensor voltage of less than 0.82 volt with engine running for 5 seconds.

Conditions for setting DTC:

- Engine run time greater than 5 seconds.
- ECT less than 0.25 volt (low resistance pull-up).
- ECT less than 0.25 volt (high resistance pull-up).

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Turn engine on and allow it to idle. Using scan tool, read ECT sensor voltage. If voltage is less than 0.82 volt, go to next step. If voltage is not less than 0.82 volt, go to step 5).
3. Turn engine off. Disconnect ECT sensor harness connector. Turn ignition on. If voltage is greater than 4 volts, go to step 7). If voltage is not greater than 4 volts, go to next step.
4. Turn ignition off. Using DVOM, check resistance across ECT sensor harness connector. If resistance is infinite, go to step 8). If resistance is not infinite, go to step 6).
5. DTC P1114 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.
6. Repair short to ground in ECT sensor signal circuit. After repairs, go to step 9).
7. Replace ECT sensor. After replacing sensor, go to step 9).
8. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
9. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1114. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
10. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for short to ground in ECT sensor harness connector 5-volt reference circuit. Observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

Check for skewed ECT sensor. See **ECT TEMPERATURE-TO-RESISTANCE VALUES** .

DTC P1115 - ECT SENSOR CIRCUIT INTERMITTENT HIGH VOLTAGE

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Engine Coolant Temperature (ECT) sensor is a thermistor or a variable resistor, that varies resistance based on temperature. As temperature of sensor increases, resistance decreases. Low temperature will result in a high signal voltage. DTC will set when VCM sees an ECT sensor voltage of greater than 5 volts.

Condition for setting DTC:

- Engine run time greater than 5 seconds.

- ECT greater than 4.9 volts.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Turn engine on and allow it to idle. Using scan tool, read ECT sensor voltage. If voltage is greater than 4.9 volts, go to next step. If voltage is not greater than 4.9 volts, go to step 5).
3. Turn engine off. Turn ignition on. Disconnect ECT sensor harness connector. Connect a jumper wire across ECT sensor harness connector. If voltage is less than 0.82 volt, go to step 6). If voltage is not less than 0.82 volt, go to next step.
4. Connect jumper wire between ECT sensor harness connector signal circuit and chassis ground. If voltage is less than 0.82 volt, go to step 7). If voltage is not less than 0.82 volt, go to step 8).
5. DTC P1115 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, go to DIAGNOSTIC AIDS.
6. Inspect VCM and ECT sensor for proper connection. If a problem is found, go to step 10). If connections are okay, go to step 11).
7. Check ECT sensor harness connector ground circuit for open between VCM and ECT sensor. If open is found, go to step 10). If open is not found, go to step 12).
8. If DTC P0123 is also set, go to **DTC P0123** . If DTC is not set, go to next step.
9. Check ECT sensor harness connector signal circuit for open between VCM and ECT sensor. If open is found, go to next step. If open is not found, go to step 12).
10. Repair circuit as necessary. After repairs, go to step 13).
11. Replace ECT sensor. After replacing sensor, go to step 13).
12. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1115. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
14. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or open in 5-volt reference and ground circuits. Check for skewed ECT sensor. See **ECT TEMPERATURE-TO-RESISTANCE VALUES** .

DTC P1121 - TP SENSOR CIRCUIT INTERMITTENT HIGH VOLTAGE

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Throttle Position (TP) sensor measures amount of throttle opening. VCM uses TP sensor information for fuel delivery calculations. TP sensor readings during acceleration are much higher than those during deceleration or idle.

Condition required to set DTC is:

- TP signal voltage is greater than 4.8 volts.
- MAP is less than 7.4 psi (0.51 kg/cm^2) for greater than 4 seconds with engine running.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. With throttle closed, use scan tool to read TP signal voltage. If voltage is greater than 4.8 volts, go to next step. If voltage is not greater than 4.8 volts, go to step 6).
3. Disconnect TP sensor harness connector. If voltage is less than 0.2 volt, go to next step. If voltage is not less than 0.2 volt, go to step 5).
4. Connect a test light between TP sensor harness connector ground circuit and battery voltage. If test light illuminates, go to step 7). If test light does not illuminate, go to step 9).
5. If DTC P0108 is also set, go to **DTC P0108** for diagnosis. If DTC is not set, go to step 8).
6. DTC P1121 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.
7. Check for faulty connection at TP sensor. If faulty connection is found, go to step 10). If connection is okay, go to step 11).
8. Check for short to voltage in TP sensor harness connector signal circuit. If short is found, go to step 10). If short is not found, go to step 12).
9. Check for open in TP sensor harness connector ground circuit. If circuit is open, go to next step.
10. Repair circuit as necessary. After repairs, go to step 13).
11. Replace TP sensor. After replacing sensor, go to step 13).
12. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1121. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
14. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for and repair the following condition(s):

- Throttle plate sticking or excessive deposits on throttle plate or throttle bore.
- Check TP sensor harness connector ground circuit for open, and signal circuit for short to ground.
- TP sensor signal voltage should be less than 1.25 volt with throttle closed, and greater than 4.5 volts at wide open throttle.

DTC P1122 - TP SENSOR CIRCUIT INTERMITTENT LOW VOLTAGE

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Throttle Position (TP) sensor measures amount of throttle opening. VCM uses TP sensor information for fuel delivery calculations. TP sensor readings during acceleration are much higher than those during deceleration or idle.

Condition for setting DTC:

- Engine running.
- TP sensor signal voltage less than .25 volt.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. With throttle closed, use scan tool to read TP signal voltage. If voltage is less than 0.15 volt, go to next step. If voltage is not less than 0.15 volt, go to step 5).
3. Disconnect TP sensor harness connector. Connect a jumper wire between TP sensor harness connector sensor signal and 5-volt reference circuits. If voltage is greater than 4 volts, go to step 13). If voltage is not greater than 4 volts, go to next step.
4. Connect a test light between TP sensor harness connector signal circuit and battery voltage. If voltage is greater than 4 volts, go to step 6). If voltage is not greater than 4 volts, go to step 8).
5. DTC P1122 is intermittent. If any additional DTCs are set, diagnose affected DTCs. If no additional DTCs are set, see DIAGNOSTIC AIDS.
6. Check for open in TP sensor harness connector 5-volt reference circuit. If open is found, go to step 11). If open is not found, go to next step.
7. Check for short to ground in TP sensor harness connector 5-volt reference circuit. If short is found, go to step 11). If short is not found, go to step 10).
8. Check for open in TP sensor harness connector signal circuit. If open is found, go to step 11). If open is not found, go to next step.
9. Check for short to ground in TP sensor harness connector signal circuit. If short is found, go to step 11). If short is not found, go to next step.
10. Check for faulty connection at VCM. If faulty connection is found, go to next step. If connection is okay,

go to step 13).

11. Repair circuit as necessary. After repairs, go to step 14).
12. Replace TP sensor. After replacing sensor, go to step 14).
13. Replace VCM. Program replacement VCM using required equipment. After replacing PCM, go to next step.
14. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1122. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
15. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for and repair the following condition(s):

- Throttle plate sticking or excessive deposits on throttle plate or throttle bore.
- Check TP sensor harness connector 5-volt reference circuit for open or short to ground, and repair as necessary.
- TP signal voltage reading on scan tool should be less than 1.25 volt with throttle closed, and greater than 4.5 volts at wide open throttle.

DTC P1133 - HO2S INSUFFICIENT SWITCHING BANK 1, SENSOR 1

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM determines if HO2S is functioning properly by reading number of Lean/Rich (L/R) and Rich/Lean (R/L) switches.

Conditions required to set DTC are:

- No fuel trim DTCs set.
- L/R and R/L switches less than 30.
- No ECT, IAT, MAP, or TP sensor DTCs set.
- No EGR or EVAP DTCs set.
- DTC P0135 not set.
- Vehicle operating in closed loop mode.
- HO2S voltage 0.3-0.6 volt.
- TP angle value 10-20 percent.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. If any other DTCs are set, diagnose affected DTCs. If no other DTCs are set, go to next step.
3. Turn engine on and allow it to idle. Using scan tool, read MAP sensor voltage. If voltage is greater than 4 volts, go to **DTC P0108** . If voltage is not greater than 4 volts, go to next step.
4. Check air intake duct for improper installation, collapse, restriction, or missing or plugged air filter. Check throttle body and intake manifold for vacuum leaks. Check throttle body for damage to inlet or foreign objects blocking inlet, or for coking. Check exhaust system for corrosion, leaks, loose or missing hardware. Check HO2S for proper installation and for HO2S harness not contacting exhaust manifold. Check vacuum hoses for splits, kinks and proper connections. Check for fuel contamination. Check for good VCM and sensor grounds. If any of these items isolate or require repair, go to step next step. If all items are okay, go to step 6).
5. Repair or replace as necessary. After repairs, go to step 10).
6. Perform INJECTOR BALANCE TEST under FUEL SYSTEM in the SYSTEM/COMPONENT TESTS article. If an injector problem is found, go to step 9). If injectors are okay, go to next step.
7. Remove and inspect HO2S (bank 1, sensor 1) for contamination. If contamination is evident, go to next step. If contamination is not evident, see DIAGNOSTIC AIDS.
8. Replace HO2S. After replacing sensor, go to step 10).
9. Replace fuel injector(s). After replacing injector(s), go to next step.
10. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1133. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
11. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check HO2S heater operation.

DTC P1134 - HO2S TRANSITION TIME RATIO BANK 1, SENSOR 1

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM reads Heated Oxygen Sensor (HO2S) activity for 100 seconds. During this period, VCM counts the number of Lean/Rich (L/R) and Rich/Lean (R/L) switches.

With this information, an average time for all transitions can be determined. VCM then divides R/L average by

L/R rich average to obtain a ratio. If HO2S ratio is not within range, DTC will set.

Conditions required to set DTC are:

- No fuel trim DTCs set.
- L/R and R/L switches less than 30 counts.
- No ECT, IAT, MAP, or TP sensor DTCs set.
- No EGR or EVAP DTCs set.
- DTC P0131, P0132, P0134 or P0135 not set.
- Vehicle operating in closed loop mode.
- HO2S voltage 0.3-0.6 volt.
- TP ANGLE value 10-20 percent.
- Average response time calculated for this ignition cycle.
- Ratio of HO2S (bank 1, sensor 1) L/R to R/L switches greater than 64 counts.
- Ratio of HO2S (bank 1, sensor 1) L/R to R/L switches greater than 48 counts.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. If any other DTCs are set, diagnose affected DTCs. If no other DTCs are set, go to next step.
3. Turn engine on and allow it to reach normal operating temperature. Set engine speed at 1200-2000 RPM for 2 minutes. Using scan tool, read HO2S BANK 1 SENSOR 1 voltage. If voltage rapidly switches from less than 0.3 volt to greater than 0.6 volt, go to next step. If voltage does not switch as specified, go to step 5).
4. With engine speed still at 1200-2000 RPM, read LOOP MODE. If scan tool displays CLOSED LOOP, see DIAGNOSTIC AIDS. If scan tool does not display CLOSED LOOP, go to step 8).
5. If voltage stays within 0.3-0.6 volt longer than it stays out of range, go to step 10). If voltage stays outside 0.3-0.6 volt longer than it stays within range, go to next step.
6. Check for faulty connection at VCM HO2S (bank 1, sensor 1) terminals. If faulty connection is found, go to step 10). If connection is okay, go to next step.
7. Check for faulty connection at HO2S (bank 1, sensor 2). If faulty connection is found, go to step 10). If connection is okay, go to next step.
8. Replace HO2S (bank 1, sensor 1) and go to step 11).
9. Check for HO2S contamination caused by leaded fuel, incorrect gasket sealer or over-rich operation. If problem is found, go to next step. If no problem is found, go to step 11).
10. Repair or replace as necessary. After repairs, go to next step.
11. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1134. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

12. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Never solder HO2S wires.

DTC P1153 - HO2S INSUFFICIENT SWITCHING BANK 2, SENSOR 1

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM provides about 0.45 volt reference to Heated Oxygen Sensor (HO2S). HO2S sensor signal voltage varies from about one volt when exhaust is rich to about 0.1 volt when exhaust is lean. VCM determines if HO2S is functioning properly by reading number of Lean/Rich (L/R) and Rich/Lean (R/L) switches.

Conditions required to set DTC are:

- No fuel trim DTCs set.
- L/R and R/L switches less than 30 counts.
- No ECT, IAT, MAP, or TP sensor DTCs set.
- No EGR or EVAP DTCs set.
- DTC P0155 not set.
- Vehicle operating in closed loop mode.
- HO2S voltage 0.3-0.6 volt.
- TP angle value 10-20 percent.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. If any other DTCs are set, diagnose affected DTCs. If no other DTCs are set, go to next step.
3. Turn engine on and allow it to reach normal operating temperature. Set engine speed at 1200-2000 RPM for 2 minutes. Using scan tool, read HO2S BANK 2 SENSOR 1 voltage. If voltage rapidly switches from less than 0.3 volt to more than 0.6 volt, go to next step. If voltage does not switch as specified, go to step 5).
4. With engine speed still at 1200-2000 RPM, read LOOP MODE. If scan tool displays CLOSED LOOP, see DIAGNOSTIC AIDS. If scan tool does not display CLOSED LOOP, go to step 8).
5. If voltage stays within 0.3-0.6 volt longer than it stays out of range, go to step 10). If voltage stays outside 0.3-0.6 volt longer than it stays within range, go to next step.
6. Check for faulty connection at VCM HO2S (bank 2, sensor 1) terminals. If faulty connection is found, go

to step 10). If connection is okay, go to next step.

7. Check for faulty connection at HO2S (bank 2, sensor 1). If faulty connection is found, go to step 10). If connection is okay, go to next step.
8. Replace HO2S. After replacing sensor, go to step 11).
9. Check for HO2S contamination caused by leaded fuel, incorrect gasket sealer or over-rich operation. If problem is found, go to next step. If no problem is found, go to step 11).
10. Repair or replace as necessary. After repairs, go to next step.
11. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1153. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
12. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Never solder HO2S wires.

DTC P1154 - HO2S TRANSITION TIME RATIO BANK 2, SENSOR 1

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM reads Heated Oxygen Sensor (HO2S) activity for 100 seconds. During this period, VCM counts the number of Lean/Rich (L/R) and Rich/Lean (R/L) switches.

With this information, an average time for all transitions can be determined. VCM then divides R/L average by L/R rich average to obtain a ratio. If HO2S ratio is not within range, DTC will set.

Conditions required to set DTC are:

- No fuel trim DTCs set.
- L/R and R/L switches less than 30 counts.
- No ECT, IAT, MAP, or TP sensor DTCs set.
- No EGR or EVAP DTCs set.
- DTC P0155 not set.
- Vehicle operating in closed loop mode.
- HO2S voltage 0.3-0.6 volt.
- TP ANGLE value 10-20 percent.
- Average response time calculated for this ignition cycle.
- Ratio of HO2S (bank 2, sensor 1) L/R to R/L switches more than 64 counts.

- Ratio of HO2S (bank 2, sensor 1) L/R to R/L switches more than 48 counts.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. If any other DTCs are set, diagnose affected DTCs. If no other DTCs are set, go to next step.
3. Turn engine on and allow it reach normal operating temperature. Set engine speed at 1200-2000 RPM for 2 minutes. Using scan tool, read HO2S BANK 2 SENSOR 1 voltage. If voltage rapidly switches from less than 0.3 volt to more than 0.6 volt, go to next step. If voltage does not switch as specified, go to step 5).
4. With engine speed still at 1200-2000 RPM, read LOOP MODE. If scan tool displays CLOSED LOOP, see DIAGNOSTIC AIDS. If scan tool does not display CLOSED LOOP, go to step 8).
5. If voltage stays within 0.3-0.6 volt longer than it stays out of range, go to step 10). If voltage stays outside 0.3-0.6 volt longer than it stays within range, go to next step.
6. Check for faulty connection at VCM HO2S (bank 2, sensor 1) terminal. If faulty connection is found, go to step 10). If connection is okay, go to next step.
7. Check for faulty connection at HO2S (bank 2, sensor 1). If faulty connection is found, go to step 10). If connection is okay, go to next step.
8. Replace HO2S (bank 2, sensor 1). After replacing HO2S sensor, go to step 11).
9. Check for HO2S contamination caused by leaded fuel, incorrect gasket sealer or over-rich operation. If problem is found, go to next step. If no problem is found, go to step 11).
10. Repair or replace as necessary. After repairs, go to next step.
11. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1154. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
12. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Never solder HO2S wires.

DTC P1345 - CRANKSHAFT/CAMSHAFT POSITION SENSOR CORRELATION

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

If VCM sets DTC P1345, it has determined that distributor is installed incorrectly, or a mechanical malfunction in engine has occurred.

Condition required to set DTC is:

- With engine running, Camshaft Position (CMP) sensor pulse is not detected at correct time relative to Crankshaft Position (CKP) sensor pulse.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Start engine. Using scan tool, read engine speed (RPM). If RPM fluctuates up to twice desired RPM, go to next step. If RPM does not fluctuate as specified, go to step 4).
3. Replace CKP sensor. After replacing sensor, go to step 6).
4. Check for proper distributor installation. If problem is found, go to next step. If no problem is found, go to step 6).
5. Repair as necessary. After repairs, go to next step.
6. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1345. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
7. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

DTC P1351 - IGNITION CONTROL CIRCUIT HIGH VOLTAGE

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Crankshaft Position (CKP) sensor provides VCM with reference pulse input. VCM uses CKP input to determine ignition spark timing for each cylinder. Once VCM calculates ignition timing, it sends a signal to ignition coil module on Ignition Control (IC) circuit.

Conditions required to set DTC are:

- Engine speed less than 250 RPM.
- IC circuit voltage greater than 4.9 volts.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Clear DTCs. Disconnect fuel injector connector. Crank engine 30 seconds. Read DTCs. If DTC P1351

sets, go to next step. If DTC does not set, see DIAGNOSTIC AIDS.

3. Turn ignition off. Reconnect fuel injector connector. Disconnect ignition coil module connector. Using voltmeter in AC scale, check voltage between engine ground and IC control circuit at ignition coil module, while cranking engine. If voltage is 1-4 volts, go to step 9). If voltage is not as specified, go to next step.
4. Turn ignition off. Disconnect VCM White connector. Check resistance of IC control circuit between VCM White harness connector and ignition coil module. If resistance is less than 10 ohms, go to step 6). If resistance is not less than 10 ohms, go to next step.
5. Repair open IC control circuit between VCM and ignition coil module and go to step 16).
6. Check for faulty connection at VCM. If faulty connection is found, go to next step. If connection is okay, go to step 8).
7. Repair faulty VCM connection. After repairs, go to step 16).
8. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to step 16).
9. Turn ignition off. Connect a test light between battery voltage and ignition coil module harness connector ground circuit. If test light illuminates, go to step 11). If test light does not illuminate, go to next step.
10. Repair open ignition coil module ground circuit and go to step 16).
11. Turn ignition on. Connect test light between engine ground and ignition coil module harness connector ignition feed circuit, and then ignition coil module harness connector tachometer signal circuit. If test light illuminates on both circuits, go to step 13). If test light does not illuminate on both circuits, go to next step.
12. Repair faulty circuit. After repairs, go to step 16).
13. Check for faulty connection at ignition coil module. If faulty connection is found, go to step 15). If connection is okay, go to next step.
14. Replace ignition coil module. After replacing module, go to step 16).
15. Repair faulty connection. After repairs, go to next step.
16. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1351. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
17. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. If connections and harness appear okay, observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P1361 - IGNITION CONTROL CIRCUIT NOT TOGGLING

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Crankshaft Position (CKP) sensor provides VCM with reference pulse input. VCM uses CKP input to determine ignition spark timing for each cylinder. Once VCM calculates ignition timing, it sends a signal to ignition coil module on Ignition Control (IC) circuit.

Conditions required to set DTC are:

- EST enabled.
- Engine speed less than 250 RPM.
- EST voltage less than .40 volt.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Clear DTCs. Disconnect fuel injector connector. Crank engine 15 seconds. Read DTCs. If DTC P1361 sets, go to next step. If DTC does not set, see DIAGNOSTIC AIDS.
3. Turn ignition off. Reconnect fuel injector connector. Disconnect ignition coil module connector. Using voltmeter in AC scale, check voltage between engine ground and IC control circuit at ignition coil module, while cranking engine. If voltage is 1-4 volts, go to step 9). If voltage is not as specified, go to next step.
4. Turn ignition off. Disconnect VCM White connector. Connect a test light between battery voltage and ignition coil module harness connector IC control circuit. If test light illuminates, go to next step. If test light does not illuminate, go to step 6).
5. Repair short to voltage in IC control circuit. After repairs, go to step 14).
6. Connect test light between engine ground and IC control circuit at VCM. If test light illuminates, go to next step. If test light does not illuminate, go to step 8).
7. Repair short to voltage in IC control circuit. After repairs, go to step 14).
8. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to step 14).
9. Turn ignition off. Connect a test light between battery voltage and ignition coil module harness connector ground circuit. If test light illuminates, go to step 11). If test light does not illuminate, go to next step.
10. Repair open ignition coil module ground circuit. After repairs, go to step 14).
11. Check for faulty connection at ignition coil module. If faulty connection is found, go to step 13). If connection is okay, go to next step.
12. Replace ignition coil module. After replacing module, go to step 14).
13. Repair faulty connection. After repairs, go to next step.
14. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1361. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).

15. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. If connections and harness appear okay, observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P1380 - ELECTRONIC BRAKE CONTROL MODULE EBCM) DTC DETECTED ROUGH ROAD DATA UNUSABLE

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

This test determines if ABS system is capable of detecting a rough road situation.

Conditions for setting DTC:

- Vehicle speed at least 1 MPH.
- Engine speed less than 5800 RPM.
- Engine load not greater than 90 percent.
- DTC P0300 is set with MIL on.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Disconnect VCM and Electronic Brake Control (EBCM) module connectors. Check for open in serial data circuit between EBCM and VCM. If open is found, go to next step. If open is not found, perform ABS system diagnosis. See the BRAKES SYSTEM - ANTI-LOCK article in the BRAKES section.
3. Repair as necessary. After repairs, go to next step.
4. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1380. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
5. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. If connections and harness appear okay, observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P1381 - MISFIRE DETECTED NO EBCM/VCM SERIAL DATA

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

This test detects a serial data malfunction which could inhibit the transfer of the ABS rough road data to VCM.

Conditions for setting DTC:

- DTC P0300 is set with MIL on.
- EBCM not sending rough road data.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Disconnect VCM and Electronic Brake Control (EBCM) module connectors. Check for open in serial data circuit between EBCM and VCM. If open is found, go to next step. If open is not found, perform ABS system diagnosis. See the BRAKES SYSTEM - ANTI-LOCK article in the BRAKES section.
3. Repair as necessary. After repairs, go to next step.
4. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1381. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
5. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. If connections and harness appear okay, observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P1406 - EGR VALVE PINTLE POSITION CIRCUIT

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM constantly reads EGR valve pintle position sensor to ensure valve is responding to commands from VCM.

Conditions required to set DTC are:

- EGR pintle position signal voltage out of normal range, or 10 percent greater or less than VCM commanded position.
- Ignition voltage greater than 9 volts.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Turn ignition on. Using scan tool, read EGR PINTLE POS. If scan tool displays zero percent, go to next step. If scan tool does not display zero percent, go to step 8).
3. Using scan tool, select MISC TESTS and command EGR duty cycle through 25, 50, 75 and 100 percent positions. Compare scan tool display DESIRED EGR POSITION and ACTUAL EGR POS. If both readings are close, see DIAGNOSTIC AIDS. If readings are not close, go to next step.
4. Disconnect EGR valve harness connector. Connect a test light between EGR harness connector control and ignition feed circuits. Using scan tool, command EGR position to 100 percent. If test light illuminates, go to step 26). If test light does not illuminate, go to next step.
5. Connect test light between engine ground and EGR valve harness connector ignition feed circuit. If test light illuminates, go to next step. If test light does not illuminate, go to step 12).
6. Check for faulty connections at VCM harness and EGR valve harness connectors. Check for open circuits between VCM and EGR valve. If problem is found, go to next step. If no problem is found, go to step 8).
7. Repair faulty connection(s) or open circuit(s). After repairs, go to step 39).
8. Disconnect EGR valve harness connector. Using scan tool, read EGR PINTLE POS. If scan tool displays zero percent, go to step 16). If scan tool does not display zero percent, go to next step.
9. If DTC P0108 is also set, go to **DTC P0108** . If DTC is not set, go to next step.
10. Check for short to voltage in EGR pintle position circuit. If short is found, go to next step. If no short is found, go to step 12).
11. Repair short to voltage in EGR pintle position circuit. After repairs, go to step 39).
12. Check for blown fuse No. 4. If fuse is blown, go to next step. If fuse is okay, go to step 16).
13. Replace fuse No. 4. After repairs, go to next step.
14. Repair short to ground in EGR control circuit. After repairs, go to step 39).
15. Repair high circuit. After repairs, go to step 40).
16. Connect test light between battery voltage and EGR valve harness connector ground circuit. If test light illuminates, go to step 19). If test light does not illuminate, go to next step.
17. Check for open EGR valve ground circuit. If open is found, go to next step. If open is not found, go to step 19).
18. Repair open ground circuit. After repairs, go to step 40).
19. Connect test light between battery voltage and EGR valve harness connector low circuit. If test light illuminates, go to next step. If test light does not illuminate, go to step 23).
20. Disconnect VCM Blue harness connector. Using a test light connected to battery voltage, probe EGR harness connector terminal "A". If test light illuminates, go to next step. If test light does not illuminate, go to step 39).

21. Check for short to ground in EGR valve control low circuit. If short is found, go to next step. If no short is found, go to step 23).
22. Repair short to ground in EGR valve control low circuit. After repairs, go to step 40).
23. Check for faulty connection at EGR valve. If faulty connection is found, go to next step. If connection is okay, go to step 25).
24. Repair faulty connection at EGR harness connector. After repairs, go to step 40).
25. Replace EGR valve. After replacing EGR valve, go to step 40).
26. Using DVOM, check voltage between EGR valve harness connector ground and 5-volt reference circuits. If voltage reading is about 5 volts, go to step 31). If voltage reading is not about 5 volts, go to next step.
27. Using DVOM, check voltage between engine ground and VCM harness connector 5-volt reference circuit. If voltage is 5 volts, go to next step. If voltage is not 5 volts, go to step 29).
28. Check for faulty connection at VCM harness connector 5-volt reference circuit. If faulty connection is found, go to next step. If connection is okay, go to step 30).
29. Repair faulty connection at VCM harness connector 5-volt reference circuit. After repairs, go to step 40).
30. Repair open 5-volt reference circuit. After repairs, go to step 40).
31. Connect test light between battery voltage and EGR valve harness connector pintle position signal circuit. If test light illuminates, go to step 34). If test light does not illuminate, go to next step.
32. Check for short to ground in EGR pintle position signal circuit. If short is found, go to next step. If short is not found, go to step 34).
33. Repair short to ground in EGR pintle position signal circuit. After repairs, go to step 40).
34. Connect appropriate adapters from Connector Test Kit (J-35616) between EGR valve and EGR valve harness connector. Using DVOM, check voltage between engine ground and EGR valve pintle position signal circuit at EGR valve. Using scan tool, command EGR position to 100 percent. If voltage is 3.5-5.0 volts, go to next step. If voltage is not as specified, go to step 36).
35. Check for open in EGR pintle position circuit. Check for poor connection at EGR valve connector. If a problem is found, go to step 37). If no problem is found, go to next step.
36. Check for faulty connection at VCM harness connector pintle position signal circuit. If faulty connection is found, go to step 38). If connection is okay, go to step 39).
37. Repair open EGR pintle position signal circuit. After repairs, go to step 40).
38. Repair faulty connection. After repairs, go to step 40).
39. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
40. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1406. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
41. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for faulty connections or damaged harness. If connections and harness appear okay, observe scan tool

while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P1441 - EVAP SYSTEM FLOW DURING NON-PURGE

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

Evaporative (EVAP) emissions canister purge is controlled by a solenoid valve which allows ported vacuum to purge canister when energized by VCM. A vacuum switch in purge line is used to detect when system is being purged. VCM supplies and reads a 12-volt reference to switch. If switch is open (purge detected) when commanded by VCM, DTC P1441 is set.

Conditions required to set DTC are:

- No HO2S, ECT, EGR, IAT, MAP, TP, VSS sensor DTCs set.
- DTC P0125 not active.
- Fuel tank greater than 12.5 percent but not greater than 87.5 percent.
- System voltage is greater than 10 volts but less than 17 volts.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Turn ignition off. Remove fuel cap. Turn ignition on. Using scan tool, observe fuel tank pressure parameter. If fuel tank pressure is zero H2O, go to next step. If fuel tank pressure is not zero in. H2O, diagnose EVAP control system. See the SYSTEM/COMPONENT TESTS article.
3. Ensure gauges on Enhanced EVAP Pressure Purge Diagnostic Cart (J-41413) are zeroed. Replace fuel filler cap. Install diagnostic cart. Using scan tool, command EVAP vent on (closed). Pressurize EVAP system to 5 in. H2O using diagnostic cart. Observe fuel tank pressure on scan tool. If fuel tank pressure is 5 in. H2O, go to next step. If fuel tank pressure is not 5 in. H2O, go to step 5).
4. Maintain fuel tank pressure at 5 in. H2O. Observe fuel tank pressure parameter on scan tool. If fuel tank pressure is maintained at 5 in. H2O, go to next step. If fuel tank pressure is not maintained at 5 in. H2O, diagnose EVAP control system. See the SYSTEM/COMPONENT TESTS article.
5. Remove EVAP purge solenoid from intake manifold. Connect a hand-held vacuum pump to EVAP purge solenoid. Apply 15 in. Hg vacuum to solenoid. If solenoid holds vacuum, go to next step. If solenoid does not hold vacuum, go to step 7).
6. Check EVAP purge line for proper routing. Check for proper vacuum source to EVAP purge solenoid. Repair as necessary. After repairs, go to step 8). If no problems are found, see DIAGNOSTIC AIDS.
7. Replace EVAP purge solenoid. After repairs, go to step 9). Also, see DIAGNOSTIC AIDS.
8. Repair as necessary. After repairs, go to next step. Also, see DIAGNOSTIC AIDS.
9. Start engine. Remove fuel cap. Using scan tool, command EVAP vent valve on (closed) and EVAP purge

solenoid off (zero percent). Replace fuel cap. Run engine at 2500 RPM. Monitor fuel tank pressure parameter on scan tool. If fuel tank pressure remains at zero in. H2O, system is okay. If fuel tank pressure does not remain at zero in H2O, repeat step 2).

Diagnostic Aids

Check vacuum hoses for damage. Check for faulty connections or damaged harness. If connections and harness appear okay, observe scan tool while moving all related harness and connectors. A change in scan tool display indicates fault location.

DTC P1508 - IAC SYSTEM LOW RPM

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM controls idle speed with an Idle Air Control (IAC) valve to a calculated RPM based on sensor inputs and actual engine RPM. VCM moves IAC valve in or out to vary amount of airflow into intake manifold and thus decrease or increase idle RPM.

VCM commands IAC in counts. A higher count, allows more air to by-pass throttle plate (higher idle).

Conditions required to set DTC are:

- No ECT, MAP, TP or VSS sensor DTCs set.
- ECT greater than 122°F (50°C).
- IAT greater than -13°F (-25°C).
- BARO greater than 10.2 psi (0.72 kg/cm^2) at less than 10,300 ft.
- Vehicle speed less than 2 MPH.
- Throttle at idle or less than 1%.
- Engine running longer than 30 seconds.
- Listed conditions met for more than 3 seconds.
- Change in calculated airflow greater than 2 counts.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Turn ignition off. Connect IAC driver to IAC valve. Set parking brake, brake drive wheels and turn A/C off. Start engine and allow it to idle in Park (A/T) or Neutral (M/T). Using scan tool, read engine speed (RPM). Using IAC driver, extend and retract IAC valve. If engine RPM decreases and increases as IAC valve is cycled, go to next step. If engine RPM does not change, go to step 4).

3. If engine speed changes smoothly between 700-1500 RPM, go to step 5). If RPM does not change smoothly, go to next step.
4. Check IAC valve passage. If passage is not okay, clean passage and go to step 12). If passage is okay, replace IAC valve. Disconnect negative battery cable for 10 seconds, then reconnect cable. Turn ignition on, engine off for 5 seconds. Turn ignition off for at least 10 seconds and go to step 12).
5. Install IAC Node Light (J37027-A) in VCM harness. Cycle IAC driver and note lights. Both lights should cycle Green and Red, but not OFF as RPM changes from 700-1500 RPM. If lights flash as specified, go to step 8). If lights do not flash as specified, go to next step.
6. Check for faulty connector terminal contacts, open circuits, short to ground or voltage, faulty VCM connection. If problem is found, go to next step. If no problem is found, go to step 11).
7. Repair connection, terminal contact or circuit as necessary. After repairs, go to step 12).
8. Using other connector on IAC driver pigtail, check resistance across IAC valve coils. Check resistance of IAC coil "B" HI and LO circuits. Check resistance of coil "A" HI and LO circuits. If resistance on both coils is 40-80 ohms, go to next step. If resistance is not as specified on both coils, go to step 10).
9. Check resistance between coil "B" HI circuit and coil "A" LO circuit. Check resistance between coil "B" LO circuit and coil "A" HI circuit. Resistance should be infinite. If resistance is as specified between both coils, see DIAGNOSTIC AIDS. If resistance is not as specified, go to next step.
10. Replace IAC valve. Disconnect negative battery cable for 10 seconds, then reconnect cable. Turn ignition on, engine off for 5 seconds. Turn ignition off for at least 10 seconds. After repairs, go to step 12).
11. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
12. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1508. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
13. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for stopped IAC valve, tampered throttle stop screw, and damaged throttle or linkage. Check for fuel system running too rich or too lean. Check throttle body bore for foreign material. Reset IAC using scan tool.

DTC P1509 - IAC SYSTEM HIGH RPM

NOTE: For circuit reference, see the appropriate WIRING DIAGRAMS article. For connector and terminal identification, see CONNECTOR IDENTIFICATION .

Circuit Description

VCM controls idle speed with an Idle Air Control (IAC) valve to a calculated RPM based on sensor inputs and actual engine RPM. VCM moves IAC valve in or out to vary amount of airflow into intake manifold and thus decrease or increase idle RPM.

VCM commands IAC in counts. A higher count, allows more air to by-pass throttle plate (higher idle).

Conditions required to set DTC are:

- No ECT, MAP, TP or VSS sensor DTCs set.
- ECT greater than 161.6°F (72°C).
- IAT greater than -13°F (-25°C).
- BARO greater than 10.2 psi (0.72 kg/cm^2) at less than 10,300 ft.
- Vehicle speed less than 2 MPH.
- Throttle at idle.
- Engine running more than 30 seconds.
- Listed conditions met for more than 3 seconds.
- Change in calculated airflow more than 2 counts.

Diagnostic Procedures

1. Perform ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. See the **BASIC TESTING - 4.3L** article. Retrieve and record FREEZE FRAME and/or FAIL RECORDS data for each DTC set. Go to next step.
2. Turn ignition off. Connect IAC driver to IAC valve. Set parking brake, brake drive wheels and turn A/C off. Start engine and allow it to idle in Park (A/T) or Neutral (M/T). Using scan tool, read engine speed (RPM). Using IAC driver, extend and retract IAC valve. If engine RPM decreases and increases as IAC valve is cycled, go to next step. If engine RPM does not change, go to step 4).
3. If engine speed changes smoothly between 700-1500 RPM, go to step 5). If RPM does not change smoothly, go to next step.
4. Check IAC valve passage. If passage is not okay, clean passage and go to step 12). If passage is okay, replace IAC valve. Disconnect negative battery cable for 10 seconds, then reconnect cable. Turn ignition on, engine off for 5 seconds. Turn ignition off for at least 10 seconds and go to step 12).
5. Install IAC Node Light (J37027-A) in VCM harness. Cycle IAC driver and note lights. Both lights should cycle Green and Red, but not OFF as RPM changes from 700-1500 RPM. If lights cycle as specified, go to step 8). If lights do not cycle as specified, go to next step.
6. Check for faulty connector terminal contacts, open circuits, short to ground or voltage, faulty VCM connection. If problem is found, go to next step. If no problem is found, go to step 11).
7. Repair connection, terminal contact or circuit as necessary. After repairs, go to step 12).
8. Using other connector on IAC driver pigtail, check resistance across IAC valve coils. Check resistance between IAC coil "B" ground and signal circuits. Check resistance across coil "A" ground and signal circuits. If resistance on both coils is 40-80 ohms, go to next step. If resistance is not as specified on both coils, go to step 10).
9. Check resistance between coil "B" signal circuit and coil "A" ground circuit. Check resistance between coil "B" ground circuit and coil "A" signal circuit. Resistance should be infinite. If resistance is as specified between both coils, see DIAGNOSTIC AIDS. If resistance is not as specified, go to next step.
10. Replace IAC valve. Disconnect negative battery cable for 10 seconds, then reconnect cable. Turn ignition on, engine off for 5 seconds. Turn ignition off for at least 10 seconds. After repairs, go to step 12).

11. Replace VCM. Program replacement VCM using required equipment. After replacing VCM, go to next step.
12. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P1509. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
13. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for stopped IAC valve, tampered throttle stop screw, and damaged throttle or linkage. Check for fuel system running too rich or too lean. Check throttle body bore for foreign material. Reset IAC using scan tool.